MAY 2 4 1921

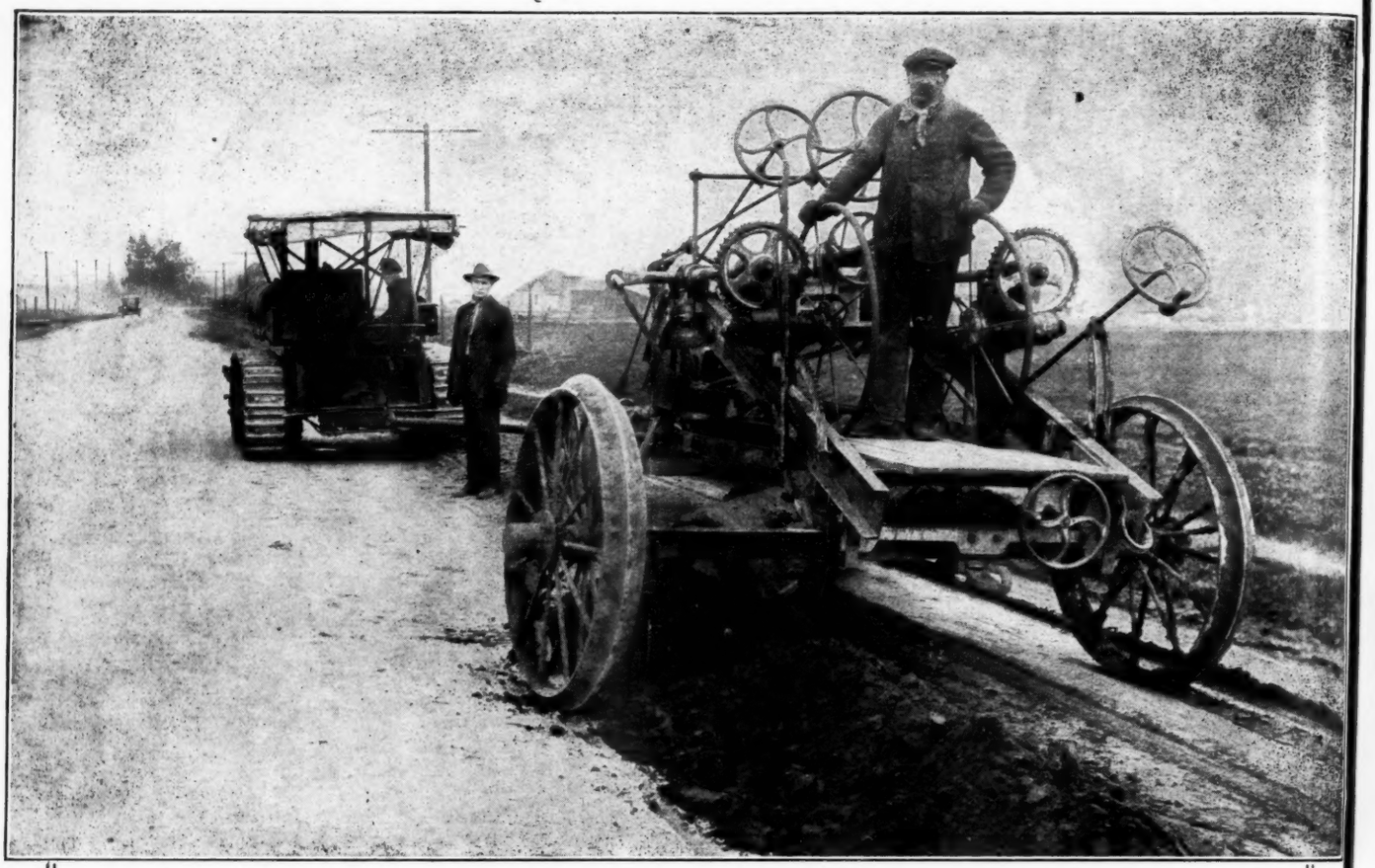
PUBLIC WORKS

CITY COUNTY STATE

WATER SUPPLY STATISTICS

IN the June 4th issue we will publish tables showing the present rates charged for water, those in effect in 1914, and the operating cost during both periods. Where no increase in rates has been made, the means used to meet the increased cost will be given.

MAY 21, 1921



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PUBLIC WORKS.

CITY COUNTY STATE

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Vol. 50 MAY 21, 1921 No. 21

Sewage Disposal at Worcester, Mass.

This is one of the oldest and most scientifically operated plants in the country, and the experiments on septic and Imhoff tanks, contact filters, trickling filters and activated sludge, that have been made here are of unusual interest and value.

The sewage treatment plant at Worcester, Mass., is one of the oldest in the country, and one of the two largest to use chemical precipitation, which method of treatment has been continued after it had been abandoned by all other cities, we believe. Providence abandoned the chemical precipitation of sewage during the war because of the impossibility of obtaining lime, permission being obtained from the federal government to substitute chlorine treatment temporarily. Following that, the freight congestion and other difficulties prevented returning to lime precipitation, but in February of this year the city decided to resume the lime treatment in a short time and preparations have continued and a contract has been let for the lime, and the renewal of chemical treatment may have taken place before this article is published.

During the past twenty years the officials in charge of the plant have conducted experiments on the various methods of treating sewage which have received general attention from time to time, such as the septic tank, Imhoff tank, activated sludge, etc. A brief review of the history of this plant and a somewhat detailed account of the experimental activated sludge plant were given in a paper before the Boston Society of Civil Engineers by Roy S. Lanphear, supervising chemist of the Worcester Sewage Department. From this paper the following has been abstracted:

Worcester's chemical precipitation plant was placed in operation March 25, 1890. In 1900 experiments on treatment were begun, settled sewage, chemical precipitation effluent, and septic tank effluent being run onto sand filters in that year. It was found that finely divided suspended matter in the septic effluent penetrated the surface of the filters and necessitated the frequent removal of large quantities of dirty sand, and filtering this effluent was abandoned in 1902. Settled sewage from chemical precipitation basins gave similar results. Effluents from chemical precipitation carried finely divided solids onto the sand filters and in addition the precipitation of lime there resulted in the formation of a hard crust on the filter, so that the rate of filtration of this effluent decreased more than 50 per cent in five years and it was necessary to remove as much as 4 inches of the material in a single cleaning in order to renew the original rate of filtration.

Late in 1904 arrangements were completed for delivering crude sewage directly to the sand filters and this method was continued until September, 1908, when change was made to the present method of passing the sewage through one or two settling basins giving a detention period of about 20 minutes; this settling being introduced to relieve the overloading of the sand filters with scum close to the distributors. It is found that "the disposal of suspended solids as sludge by pumping is much cheaper than the removal from the filters, and the short detention period of the sewage removes only the heavier and coarser suspended solids."

In 1905 septic tank effluent and settled sewage were treated in experimental contact filters, there being two primary beds and one secondary bed, each about 1,200 square feet in area and filled with 40 inches of crushed stone of ¾-inch to 2½-inch size. Results from these were unsatisfactory, a rate of 500,000 gallons per acre daily giving a putrescible effluent much of the time and the beds losing 12 per cent of their capacity in a single year. In 1906, the stone was removed from the primary beds, their depth was increased and they were used as septic tanks for one year, after which one of them was used as a settling tank for septic tank effluent, which was treated on trickling filters 5 and 7½ feet deep. In 1909 the preliminary treatment was changed to plain sedimentation, and in 1911 chemical precipitation effluent was applied to the shallower filter.

From the various experiments the following conclusions were derived:

"(1) The deeper filters gave the better effluent.

"(2) Purification was better with septic tank effluent than with settled sewage because ferrous iron of the sewage was removed to some extent in the septic tank by precipitation as sulphide of iron.

"(3) The odors accompanying filtration of septic tanks effluent were very objectionable.

"(4) Chemical precipitation effluent was filtered at a rate of 1,000,000 gallons per acre daily, and settled sewage at 700,000 gallons per acre daily with equally good results.

"(5) The cost of chemical precipitation eliminated the consideration of this process as preliminary treatment."

In 1911 an Imhoff tank and two trickling filters were placed in operation, each filter being 10 feet deep and one containing ¾-inch to 2½-inch crushed stone and the other ½-inch and 1½-inch stone. This plant was operated successfully for two years, the rate of filtration during the second year being 2,000,000 gallons per acre daily. The filter containing the coarser stone did not yield quite so good an effluent as the other, but caused much less trouble from surface pooling. Its effluent was non-putrescrible during warm weather and during the winter about 75 per cent of the samples treated were non-putrescible.

It was appreciated by those in charge that chemical precipitation of sewage was inefficient and costly, and in 1916 the superintendent of sewers recommended changing to a plant consisting of Imhoff tanks and trickling filters. At about the same time the State Department of Health began urging a new plant of this type.

Meantime, early in 1917, an experimental plant using the activated sludge process was constructed and placed in operation, in keeping with the general policy of the sewer department to test every promising method of sewage treatment. After 13 months of operation the supervising chemist was called to military service and consequently report upon the operation of the plant was not completed before November, 1919. This report indicated that the air requirements of treating Worcester sewage by the activated sludge process were large and the sludge disposal a serious problem. Six months before this report was available the state legislature passed an act requiring the city of Worcester to start work on a new sewage disposal plant before October of that year and to have the plant in operation by April 1, 1924. The superintendent of sewers again recommended the adoption of the Imhoff tank and trickling filter, the State Department of Health approved this and also the location proposed for the new plant, and the site of this plant is now being prepared and the outfall sewer extended to it.

ACTIVATED SLUDGE EXPERIMENTS

Mr. Lanphear devoted the larger part of his paper to a description of the experimental activated sludge plant and the results obtained in its operation, which we have considerably abbreviated in the following paragraphs:

The sewage treated in this experimental plant first passed through a bar screen with ½-inch openings and a grit chamber. Thence it entered a sewage aeration tank with a capacity of 25,283 gallons, with filtros plates in the bottom. The effluent from this passed to a sedimentation tank of the Dortmund type 14 feet in diameter and 9.6 feet deep. The sludge was lifted from this tank by air lift and discharged to either the sewage aeration tank, the sludge aeration tank, or to sludge tanks. A part of the sludge, with or without aeration, was returned to the sewage just before it entered the sewage aeration tank. The sludge re-aeration tank had a capacity of 4,386 gallons.

From 75,000 to 125,000 gallons of sewage was treated daily, using from 2 to 5 cubic feet of free air per gallon, the sewage being aerated from 3.8 to 6.2 hours and the sludge from 2.8 to 6.5 hours. Careful records were kept of all temperatures and it was found possible to operate the activated sludge process in this New England climate, where, for a period of 6 weeks, the average maximum temperature of the air was below 32 degrees, the minimum during one week varying from 16 degrees to 2 degrees below zero.

Foaming occurred in the sludge re-aeration tank during the first ten days of operation and it was necessary to raise the tank walls 6 inches and cover the tank with chicken wire to prevent the foam from going over the walls. Foaming also occurred at other times, usually with the aeration of activated sludge of poor quality.

Analyses of the air after use in the aeration tanks showed that oxygen was removed and carbon dioxide formed, about 2.1 and 4.3 per cent in the sewage and the sludge aeration tanks, respectively. A small amount of methane and heavy hydrocarbons also was formed.

There was a general lack of reduction of free ammonia by this process, considerable reduction of albuminoid ammonia and oxygen consumed, from 85 per cent to 95 per cent removal of suspended solids, about 90 per cent removal of iron, and an entire absence of nitrification. Clarification was generally excellent and in the absence of nitrification exerted considerable influence upon the stability of the effluent. The dissolved oxygen content of the effluent usually averaged from 20 per cent to 30 per cent of saturation, but many times was zero in the afternoon. In general effluents having less than 0.2 part of total albuminoid ammonia, about 0.05 part of suspended albuminoid ammonia and less than 3.0 parts of suspended solids were of good appearance but the stability was variable, being influenced by the actual content of organic matter and suspended solids. The effluent generally contained from 50,000 to 350,000 bacteria per c. c.

Worcester sewage contains so much trade wastes of such varying character and quantity that nitrification did not take place with the quantities of air and periods of aeration used, but a stable effluent was obtained by the reduction of the organic content. Owing to lack of nitrification and low dissolved oxygen content, there was no factor of safety or stability of the effluent such as is usually present in effluents from the biological processes and consequently sewage of greatly varying character was not uniformly well

treated. Greater quantities of air and longer periods of aeration would probably have produced better results in this respect.

Comparing this process with the Imhoff tank and trickling filter plant, the latter, treating stronger sewage and operating at a rate of 2,000,000 gallons per acre, gave an effluent which was generally slightly turbid and even slightly colored at times, and of greater organic content, but it contained about 0.5 part of nitrogen as nitrates and was perfectly stable during warm weather and 75 per cent of the time during the winter; while the activated sludge effluent was generally clear, colorless and of good chemical quality, but lacked stability.

After analyzing the results of the experiments, Mr. Lanphear stated that they indicated, but with considerable uncertainty, that "a total quantity of about 4 cubic feet of free air per gallon of sewage, 6 hours aeration of sewage and 6 hours re-aeration of sludge, using about 25 per cent returned sludge and treating average to strong sewage, should give a final effluent of good chemical quality and having a stability of from 75 per cent to 90 per cent."

Here, as at other plants, the sludge problem was considered an important one. The quantities were found to be much greater than those produced by any other process of treatment tried at Worcester, varying from 12,000 gallons per million gallons of sewage in summer to 25,000 gallons in winter. The sludge contained from 97.1 per cent of moisture in summer to 98.7 per cent in winter. The dried sludge contained from 50 per cent to 70 per cent of organic matter, from 8.5 per cent to 18 per cent of iron, from 2 per cent to 9 per cent of fats, and from 4 to 6.5 per cent of nitrogen. Worcester activated sludge was found as dense as that which has been obtained elsewhere, and it was believed that it would be difficult to obtain, without concentration, activated sludge having less than 97 per cent moisture.

Most of the sludge was dried upon sand beds, but this was decided to be impracticable because the beds could not be dosed to a greater depth than 4 or 5 inches. Concentration experiments were made in two tanks, one 6 feet deep and the other 18½ feet deep. Heavier sludge could be drawn from the bottom of the deeper tank if extremely long periods of concentration were used, but in no instance was sludge obtained containing less than 95 per cent moisture. Concentration of sludge for from 15 to 24 hours decreased the volume about 50 per cent and the water content from 98 per cent to 96 per cent.

Pressing the sludge was attempted in a section of a press of the Bushnell type which had been used in the plant for chemical precipitation sludge, but it was found to be unsuitable for pressing activated sludge unless about 2,500 pounds of lime in the form of milk of lime were added to 100,000 gallons of sludge and pressing continued for about two hours at 60 pounds per square inch. It was believed that to be successful, a press should de-water the sludge to about 70 per cent. moisture during the first 20 or 30 minutes of operation, and the addition of lime should not be necessary.

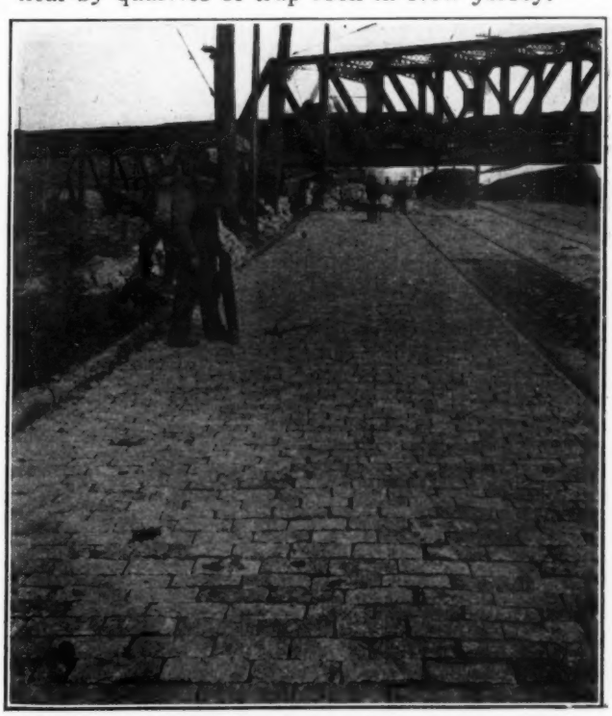
Comparisons were made between activated sludge and that from the Imhoff tank and final settling basins as fertilizers. The total nitrogen content of the activated sludge was about 60 per cent greater than either of the others, but the available nitrogen, while somewhat greater than the Imhoff tank sludge, was less than that in the settling basin sludge, and the same was true of total phosphoric acid. Based on the unit quantity of sewage treated, the nitrogen content of activated sludge was approximately 2½ times as great as combined Imhoff tank and final settling basin sludge. But if revenue is desired from the nitrogen content, facilities would have to be provided for handling six times as much unconcentrated or three times as much concentrated activated sludge as of the other two sludges combined.

Improved Heavy Traffic Pavements in Jersey City

By Clarence D. Pollock

Granite blocks laid on both old and new foundations, with hot asphalt mastic filler. Special attention paid to details.

Jersey City, N. J., has been greatly hampered for funds for street improvements due in a large measure to the fact that so much of its most valuable portions, including its water front, is owned by the railroads and consequently under state control and taxation. As a result the city was paved largely with both new and second-hand Belgian blocks which were obtained from near-by quarries of trap rock in New Jersey.



LAYING GRANITE PAVEMENT ON PACIFIC AVENUE

During the past few years great progress has been made in getting improved pavements, both in the selection of materials and in improved workmanship. The city has a commission form of government, Michael I. Fagan being the present Director of Streets and Public Improvements, while C. A. Van Keuren is the chief engineer.

Two important improvements carried out during the past year were the repaving of Newark avenue from Summit avenue to Westside avenue, excepting the portion in the tracks; and the repaving of Grand street from Mill Creek to Communipaw avenue, together with portions of Communipaw avenue and Pacific avenue, except the area in the railway tracks. These two contracts were for improved granite block pavement on concrete base with an asphalt mastic used as a joint filler.

The Newark avenue contract amounted to 7,500 square yards over old concrete foundation, and the other contract to 24,610 square yards, of which 3,710 square yards was over the old concrete base and 20,900 square yards was on a new concrete base 8 inches thick.

Jersey City contracts are let on the percentage method. The engineer makes a detailed estimate of quantities, giving unit prices, and the total of this estimate is taken as 100 per cent. The contractors submit their bids as percentages of the total of the engineer's estimate, the object being, of course, to eliminate unbalanced bidding. On Newark avenue the percentage bid was 99½ per cent, while on Grand street it was 120 per cent. The low bidder on Grand street was Graham Van Keuren, of Jersey City, and on Newark avenue William Van Keuren was the lowest bidder.

The blocks specified in each of these contracts were the standard granite blocks from 8 to 12 inches in length, 3½ to 4½ inches in width and 4¾ to 5¼ inches in depth, laid upon a sand cushion not to exceed one inch in depth; upon a portland cement base 8 inches thick where a new foundation was used.

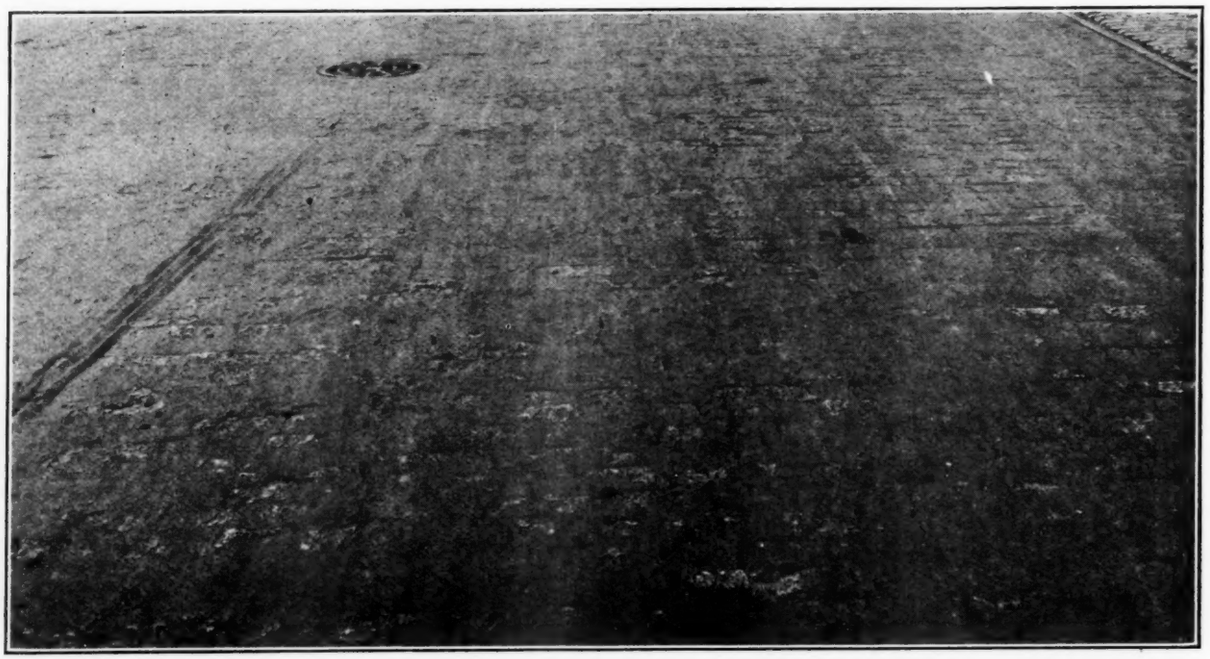
The specifications called for blocks so dressed that the faces would be approximately rectangular in shape, and the ends and sides sufficiently smooth to permit the blocks to be laid with joints not exceeding one-half inch in width at the top and not exceeding one inch in width at any other part of the joint. The head of the block was to be so cut that there would be no depressions measuring more than three-eights of an inch from a straightedge laid in any direction on the top and parallel to the general surface thereof.

The blocks were paved in straight courses at right angles to the length of the street and the longitudinal joints were broken by a lap of at least three inches. Great care was given to the ramming of the pavement and it was specified that the ratio should be not less than two rammermen to five pavers employed on the work. It is very important that the pavement be thoroughly rammed as the success of the result depends so largely upon this part of the work.

Special attention was devoted to securing an even sand cushion of one inch under the blocks. In earlier work defects had developed and were probably due largely to great variation in depth of the cushion.

Formerly the improved granite block pavements had been laid with portland cement grout, but this work was not wholly satisfactory because of pea-stone in joints or uneven sand cushion and the like which cause the filler to break out in places. Hence on these contracts a change was made to bituminous joint filler which has proved very successful. The joint filler was a hot asphalt mastic, the specifications for which were as follows:

The joint filler used shall be a mixture of paving cement



COMPLETE GRANITE PAVEMENT ON GRAND STREET

described hereafter, and hot dry sand, in the proportion not to exceed one part sand to one part paving cement by volume, or as much sand up to this proportion as the paving cement will carry. The sand shall all pass a 10-mesh sieve. It shall be clean and heated to a temperature of not less than 300 degrees Fahrenheit, nor more than 400 degrees Fahrenheit, and shall be within these limits when mixed with the paving cement. The paving cement shall be heated in kettles, properly equipped with an approved thermometer, to a temperature of not less than 325 degrees Fahrenheit, nor more than 400 degrees Fahrenheit, and shall be poured when between these limits.

The mixture shall be made in a concrete carrier pushcart of seven (7) cubic feet capacity, or other approved receptacle.

Approximately 2¼ cubic feet of the hot asphalt cement shall be poured into the cart, the hot sand then added in the proportion indicated above, and the mixture thoroughly stirred with a rake or perforated hoe. The mixture shall then, without delay, be flushed on the surface of the blocks and pushed into the joints by squeegees or other approved means, reflushing or repouring if necessary, until the joints remain permanently filled, flush with the surface of the pavement. The cart or container shall be entirely emptied before refilling.

The appliances for heating the materials for filling the joints shall be of such efficiency and numbers as will permit the pourers to follow closely the rammers, and all joints of rammed pavement shall be poured with the filler before the cessation of work for the day. In case rain stops the filler gang before its work is finished, the joints shall be protected by tarpaulins or other means, so as to keep out the water. Under no circumstances shall the filler be poured into wet joints.

The paving cement shall be asphalt paving cement, as hereinafter specified.

The asphalt paving cement shall be obtained by the distillation of the asphaltic petroleum at a temperature not exceeding 700 degrees Fahrenheit, and shall comply with the following requirements:

(a) It shall be homogeneous.

(b) Melting point shall not be less than 115 degrees Fahrenheit nor more than 130 degrees Fahrenheit. (Ball and ring method.)

(c) Solubility in carbon tetrachloride shall not be less than 98½ per cent.

(d) Penetration at 77 degrees Fahrenheit shall not be less than 60 nor more than 100, the penetration test being made with a No. 2 needle for five seconds under a load of 100 grams; and the penetration at 100 degrees Fahrenheit shall not exceed three and one-quarter (3¼) times its penetration at 77 degrees Fahrenheit, the condition of time and load being as above established. The contractor, before beginning work, shall obtain from the engineer a statement in writing as to the penetration desired for any particular contract, and a variation of not more than 10 points either way from this penetration will be permitted.

(e) Ductility at 77 degrees Fahrenheit shall not be less than 40 centimeters at the penetration called for.

(f) It shall not lose more than 3 per cent by volatization when maintained at a temperature of 325 degrees Fahrenheit for five hours, nor shall the penetration of the residue after such heating be less than one-half the original penetration.

No traffic of any description shall be permitted on the pavement until the joints have been completely filled with the bituminous filler as described and it has hardened.

The contract prices for granite block pavements shall cover the cost of materials and labor necessary to furnish and lay the pavement as specified, cost of furnishing such samples for testing as may be required, the cost of providing thermometers as specified, and the cost of maintaining the pavement in good condition as required by the contract."

Due to the care in drawing the specifications and the laying of the pavements, good results have been obtained. The surface of these pavements is smooth and even and the joints are thoroughly filled with the asphalt mastic. The result is very creditable to Director Fagan and Chief Engineer Van Keuren.

Effects of Organic Impurities on Concrete

Minute quantities of tannic acid reduce strength one half. Surface loam always reduces strength. Other conclusions from an investigation.

It has long been recognized that impurities of an organic nature reduce the strength of concrete, even in some cases entirely destroying the hydraulic properties of the cement. This is probably the reason for the weakness of concrete caused by the addition of loam in small quantities, although small percentages of clay thoroughly admixed do not seem to be injurious.

A general investigation of the effect of organic impurities has been conducted by Prof. Duff A. Abrams of Lewis Institute, and the results have been published recently by the Structural Materials Research Laboratory as a reprint from the Proceedings of the American Society for Testing Materials for 1920.

It was impossible to secure natural sands containing different known percentages of organic materials for a study of the quantitative effect of such impurities, and the laboratory therefore investigated the effects of tannic acid as a surface coating for sand particles, having decided that the effect upon the strength of concrete was practically the same as that of the organic impurities found in top soil. These investigations were begun in 1915 and continued for four years or more. Tannic acid was applied as a surface coating in various quantities up to 0.4 per cent by weight. Compression tests were made on 3-inch by 6-inch concrete cylinders. Mixes were used varying from 1:5 to 1:2. The size of aggregate ranged from a fine sand to a ¾-inch graded aggregate. Tests were made on all mixtures and sizes of aggregates at ages of 7 days, 28 days, 3 months, 1 year and 2 years, specimens being stored in damp sand. About 2,000 tests were made in this investigation. The principal conclusions from the investigation were as follows:

1. It is believed that the results of these tests are, in general, typical of the effect produced by organic impurities in concrete, judging from tests with natural sands containing organic matter, made in Lewis Institute and other laboratories.

2. The strength of concrete was reduced for all percentages of tannic acid, for all mixes and ages covered by these tests. Less than 0.1 per cent of tannic acid in terms of the weight of the aggregate may reduce the strength of the concrete to one-half its normal value.

3. Lean mixtures are more affected by tannic acid than the rich ones.

4. The mixtures from the finer aggregates are less affected by tannic acid than those from the coarser aggregates.

5. All of the effects mentioned above may be summed up by saying that the reduction in strength of concrete is a function of the concentration of

tannic acid in the mixing water. An equation is given which represents this relation for the 28-day tests.

6. The results of these tests indicate that the wetter consistencies would be less affected by the presence of organic impurities than the drier ones.

7. The strength falls off rapidly for small percentages of tannic acid and less rapidly as higher percentages are reached.

8. The 7 and 28-day strengths are reduced to a greater extent by tannic acid than at ages of 1 and 2 years.

9. Some of the 1:5 mixes in which the higher percentages of tannic acid and the finer sands were used (2 to 3 per cent solution) disintegrated before the time of test. The 1:7 mixes (3 to 5 per cent solution) were destroyed in removing the molds.

10. The tests confirm the results of many other investigations made in this laboratory in showing the fundamental dependency of strength of concrete on the quantity of mixing water as expressed by the water ratio.

11. The strength of concrete (stored in a damp place) both with and without tannic acid increased with age. The strength for a given condition was a logarithmic function of the age.

The paper herein referred to gives the complete figures of the tests on which these conclusions are based and also diagrams prepared from such figures.

Attention is called to the colorimetric test using sodium hydroxide as a convenient method of testing for organic impurities in natural sands. This test consists of shaking the sand thoroughly in a dilute solution of sodium hydroxide (NaOH) and observing the resultant color after the mixture has been allowed to stand for a few hours. For this purpose fill a 12-ounce prescription bottle to the 4½ ounce mark with the sand to be tested. Add a 3 per cent solution of sodium hydroxide until the volume of sand and solution, after shaking, amounts to 7 ounces. Shake thoroughly and let stand for 24 hours. If the solution at the end of that period is colorless or has a light yellowish color, the sand may be considered satisfactory in so far as organic impurities are concerned. On the other hand, if a dark colored solution is produced, the sand should not be used in high-grade concrete, or used only after mortar strength tests have shown it to be satisfactory for the purpose.

The report states that surface loam always decreases the strength of a properly proportioned concrete, both because of the presence of organic materials and also because additional water is required to produce a concrete of a given plasticity. There are cases in which a coarse sand will give a stronger concrete if loam or other finely divided material be added, but in such cases the addition of fine sand would be much better, the increase in strength due to the better grading of aggregate secured by the addition of loam being more than sufficient to counterbalance the ill effects of the organic material.

It seems to be definitely indicated by these results that care should be taken to eliminate surface loam from sands to be used in mortar or concrete.

Care should always be taken to remove the overburden of soil in sand and gravel pits. Washing conducted on a comprehensive scale is generally effective in removing loam when mixed with sand or gravel.

PREPARING TO DYNAMITE PAVEMENT CONCRETED IN COLD WEATHER

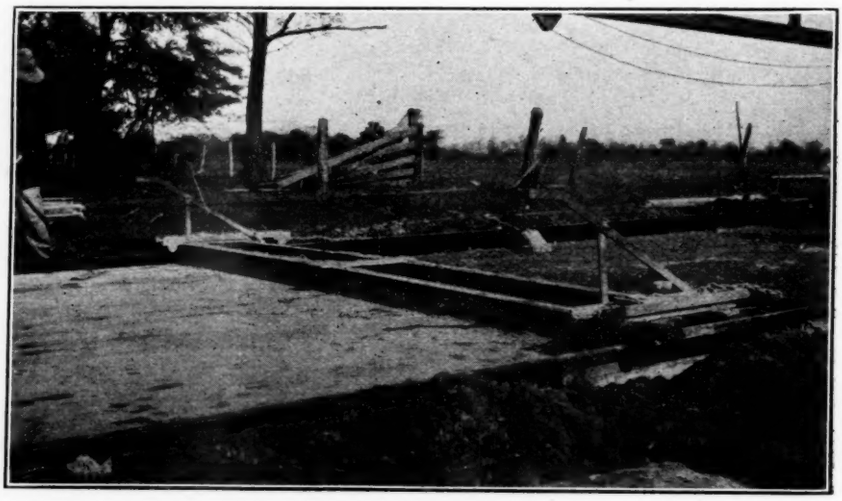
Results of Concreting a Highway in Cold Weather

A portion of Federal Aid Project 22 in Pennsylvania was concreted during freezing weather and the pavement was so much injured by the frost that it was condemned.

The slabs were broken up by charges of dynamite that raised up the surface and broke it into fragments that could be reduced with picks and sledges and removed to permit the new concrete to be laid in its place.

Constructing a Brick Highway in Illinois

The brick pavement for Federal Aid Project 9 in Illinois is made with a sand-cement cushion on concrete foundation as shown in the illustration.



STRIKE-OFF FOR SAND-CEMENT CUSHION OF BRICK PAVEMENT

After the cement and sand had been placed on the foundation they were leveled accurately by means of a special striker having two transverse wooden straightedges, set to the exact level and supported at each end by a truck with an extended wheel base, giving it firm bearing on the forms on each side of the roadway. The trucks were each made with a pair of long wooden rollers and the striker was provided at each end with an inclined handle about breast high by which it was conveniently manipulated. The brick laying was maintained as close as convenient to the concreting. A space was left on each side of the brick surface that was afterwards finished to make the shoulder.

Pumps for Small Water Plants

In a paper before the Indiana Sanitary and Water Supply Association entitled "Rebuilding of Water Works," Charles Brossman described some changes made in the pumping plants of several Indiana cities. He believed that the small water utility presented a more difficult problem in its pumping plant than the large installation.

The town of Delphi, finding it necessary to cut down the operating cost of its steam plant, considered a new high-duty steam pump, pumping by different types of electrical equipment, and continuing to use the present equipment but cutting done the pumping time by installing a large elevated tank. It had cost $4,827 a year to operate the old pumps.

Using a high-duty steam pump without any change in labor, the total yearly cost figured $3,695, which, adding interest and depreciation at 10 per cent, would total $4,585. If a large tower had been installed in order to cut down the hours of pumping, the labor item would have been cut in half, but the interest and depreciation on the tower would have brought the total up to $5,500. Using electric driven pumps, making the plant automatic and cutting out all labor, it was estimated that the yearly cost would be less than $2,000, or about $2,800 with interest and depreciation added. Electric pumps were adopted.

For reserve power in case there should be an interruption in the electric current, oil and gasoline engines were considered and it was found that the gasoline engine fulfilled the requirements to better advantage than oil, being cheaper and more quickly started, although more expense to operate. Mr. Brossman advised that in selecting reserve pumping plant it is better to pay a little more and get a slower speed engine.

In Van Buren, a town with 1,200 population, current is furnished for pumping purposes at 2½ cents. Two pumps were installed, each of 125 g. p. m. and geared to a 10 h. p. slip-ring motor. These pumps are both controlled by a special design of automatic control having two regulators for each outfit. The pumps discharge into the main and are connected with a pressure tank 5 feet in diameter by 20 feet long. The motors are arranged for two speeds. One of the regulators will start the pump and run at a slow speed, and should the pressure continue to drop the second regulator will bring the pump up to speed. On the pressure dropping still further, the second pump will cut in, first at half and then at full speed, until the total capacity of the plant is in service; and as the pressure increases the pumps will cut out of service again in reverse manner. In case of fire, a double-throw switch is used and thrown directly across the line, cutting out the automatic control and permitting a pressure of 90 pounds to be reached, excess pressure being taken care of by a relief valve.

This system has about 9,000 feet of mains and 18 fire hydrants and the entire plant was installed for $9,500 and is operated by the town marshall, who is also street commissioner and receives $20 a month for this service. In this plant the total cost of current for one year was $182 or about 21.7 cents per consumer per month. The test on the pump, allowing 5 per cent for slip, showed 600 watts per 1,000 gallons pumped, or 1,675 gallons per k. w. h. when the pump was first installed.

Duplicate Supply Mains

Water works men generally recognize the importance of insuring continuous service by providing duplicate pumping machinery, especially where the service is by direct pumping, and also duplicate mains between the pumping plant or reservoir and the town so that the service may not be entirely interrupted, as it would be in case of a break in an only main.

In spite of the self-evident desirability of such precaution, there are still many cities where the water official or departments find it impossible to obtain funds for duplicating the supply main, and the reading of many reports of water works officials brings to light numerous requests of this kind repeated year after year.

One of these is the city of Augusta, Ga. Fate seems to be particularly kind to that city in that it not only has heretofore refrained from permitting a break in the supply main which is the only one leading to the city, but last year gave the officials a gentle reminder of the seriousness of their situation without causing it to be really serious—that time. Last December this 24-inch main developed a crack which, had it occurred two blocks further east, would have made it necessary to cut off the water supply of the entire city for a period of about ten hours while the main was being repaired. A fire burning unchecked for ten hours could destroy many times the cost of a duplicate main. The reservoir is nearly three miles from the city and the cost of a duplicate main is estimated by the superintendent, J. H. Ferguson, to be about $91,000; but, backed by the reminder of the dire possibility just referred to, he urges that if necessary other improvements be held up so that the money can be obtained for carrying out this necessary work. "In view of the large sums of money that have been expended on improvements of far less importance, it is astounding that various administrations have incurred the tremendous responsibility of allowing this condition to continue."

Types of Road Receiving Federal Aid

The chief of the United States Bureau of Public Roads, Thos. H. McDonald, has issued a statement in order to clear up some misconceptions which have arisen, in some cases naturally and in other cases through misleading or false statements made by those interested in certain types of pavement; also to urge that state laws or other legislation be not so drawn as to specify the types of highways to be built in the states in question.

On March 1 of this year there had been completed or were in process of construction 22,030 miles of road that had received Federal aid, of which about 70 per cent consisted of earth, sand-clay and gravel, about 22 per cent of brick, bituminous concrete and Portland cement concrete, about 7 per cent of water-bound and bituminous macadam and about 1 per cent miscellaneous. The total estimated cost of these is about $362,000,000.

In each case the state initiates the road projects but an engineer of the federal bureau inspects the roads, studies local conditions and consults with the state highway department, and no projects are approved that are not considered suited to the conditions to be met.

"Many times the question has been asked the Bureau: What type of road is best? The answer is always the same: There is no one best kind or type of road surface." There must be a careful analysis of both the engineering and economic conditions for each particular case to determine the kinds of materials that can be used successfully, and after these facts have been determined then the various types of construction that can be used economically should be brought into competition.

Attempts have been made to embody in state laws or the governing conditions of bond issues a requirement as to the type or kind of roads to be constructed. "To follow such a course would be most unfortunate. The cost must always be considered in determining the type of road surfaces which are selected, and the allowable cost must be determined by the traffic which is to be borne." To a chamber of commerce recently asking for information, the Bureau replied: "Types of highways should not be specified by law. This is a matter to be decided by the state highway department, in which should be lodged full authority both to construct and to maintain. Competition between different types of materials should be maintained and selection made to fit traffic requirements in each case. The Bureau does not recommend any one type to exclusion of others."

Concerning earth roads, Mr. McDonald says: "Properly built earth roads are the fundamental requirement in all highway improvement. Regardless of the material or type of surfacing which is to be placed, the preparation of the road bed requires the highest engineering skill and experience. The department considers that the use of adequate sums for the securing of proper location, thorough drainage, permanent bridges and culverts, and the elimination of railroad crossings is demanded if enduring improvements are to result. Federal aid is allotted to the improvement of earth roads, but only with the stipulation that a suitable surfacing will be placed as soon as funds become available. This allows the road bed to be prepared and become thoroughly consolidated before the surfacing is placed, which is highly desirable from a construction view-point. To follow such a course, however, is out of the question when a road is heavily traveled, and some form of surfacing must be provided. To care for traffic under these conditions, frequently a sand-clay or gravel surfacing is provided, which will serve for several years and yet allow the road to be maintained under reasonably heavy traffic."

Package Garbage Collection in Trenton, N. J.

Garbage for the city of Trenton is disposed of by incineration in a plant that was built about 16 years ago at a cost of $28,000 and has been extended by the addition of two more incinerating chambers costing about $4,500 each.

Previous to 1916 the garbage was collected with few requirements concerning its condition, and was received at the incinerator in bulk in a wet, unsanitary and offensive state. About 6 years ago G. B. La Barre, then director of public safety, improved the system of garbage collection which now requires all householders and others to deliver the garbage in packages placed on the curb every alternate morning, and collected by the twenty two-horse two-yard dump wagons which are able to handle it much more quickly and satisfactorily than the old wet garbage, and to carry twice as much in bulk as formerly. Ashes are collected separately by four automobile trucks and ten wagons.

Before the war it was possible to secure waterproof pager bags with a capacity of about one bushel, at a cost of 80 cents per hundred. These were generally used to contain the garbage delivered to the city collectors. With the great increase in the cost of paper the price of containers advanced so much that they have generally been dispensed with, and the garbage is now usually wrapped up in wrapping paper or newspapers to exclude wet or sloppy material or to dry it at least partially before wrapping so that the weight is less and the general character much neater and less offensive than is the case with the old bulk garbage.

With the present population of about 120,000 the average amount of garbage collected is about 40 tons per day, the incineration costs $108,000 a year, not including the collection of garbage and the collection and disposal of ashes. It requires abut 125 tons per year of soft coal to operate the incinerator which derives a considerable proportion of the fuel burned from the paper wrappings and from the dried garbage itself. The cost of the disposal is about 33 per cent less than the former cost of the disposing of the wet garbage.

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Types of Federal Aid Roads

A statement recently given out by Chief McDonald, of the United States Bureau of Public Roads, and quoted in part elsewhere in this issue, should be given the widest publicity, especially by the daily press and other papers that reach lawmakers rather than engineers and highway officials. Unfortunately more or less success has been achieved by those prejudiced in favor of different types of pavement in winning over to their special type either those at the head of state highway departments or those who have prepared the laws or bond issues by which the department's money is raised. As a result, we have for two or three years past seen certain states openly committed to building practically nothing but cement concrete roads, others committed to bituminous roads; while in states where the counties are practically supreme in road matters, we find all types and variations of surfacing adopted, each as the only one which the highway authorities then in charge will permit on work under their control.

In urging the adoption by highway authorities of their respective types, some propagandists have gone so far as to claim that their type was recommended by the Bureau of Public Roads or the only one that would be granted federal aid, but Mr. McDonald has positively denied any such preference on the part of his bureau.

As Mr. McDonald's statement so clearly expresses it, there is no best type of road. Every type that has been accepted by responsible engineers has its advantages under certain conditions. These conditions include the traffic and the kind and abundance of road materials locally available, and the financial condition of the state or county is justifiably taken into consideration in many cases.

Only after the conditions affecting a given road have been thoroughly investigated and carefully considered by a road expert competent to make decision, can it be known what kind or variation of road surface will be best for a given section or road, and for legislators to endeavor to decide what type of road shall be used exclusively in their state or county is to make probable the practical wasting of a greater or less percentage of the funds that they contemplate spending.

Engineers for Public Positions

Two resolutions adopted by the American Association of Engineers at its recent convention in Buffalo will meet with the approval of most of the profession, not from any selfish motives, but because of their belief that it would be for the best interests of the people at large. One of these was an urgent suggestion that at least one practical highway engineer be named on the proposed Federal Highway Commission to have charge of Federal Aid highway work, and the other that the existing laws of New York state be changed so as to permit the appointing of engineers as public health officers. At present the New York state law requires all such officers be physicians.

As to the latter, it is now so well established and recognized by those competent to judge that a large part of the duties of health officers lies much more fully in the field of engineering than in that of medicine, that the logic of the situation would call for the appointing of an engineer rather than of a physician. Best of all, of course, would be an engineer who has been specially educated to act as a health officer.

Engineers are specially desirable where the health officer is given charge of refuse collection, as is still the case in a number of places. Much of the unsatisfactory condition of both the collection service and the final disposal of refuse in the past was due to the fact that it was largely in the charge of physicians, the experience and temperament of which, as a class, is generally unsuited to such work; while the recent considerable advance made in both of these lines of work can be traced directly to the recognition of this fact and the placing of such work in the hand of engineers.

As to the matter of requiring a practical high-

way engineer on the Federal Highway Commission, there are arguments in favor of the stand that what is needed in such a position is administrative rather than engineering ability, engineers being employed to furnish the necessary technical knowledge. In reply to this, however, it may be said that some of our best administrative and executive talent can be found among engineers, and that by appointing one who combines ability in both lines, considerable time that would otherwise be lost in educating the commissioner to an understanding of engineering ideas, and friction due to misunderstanding, could be avoided.

Publicity for Public Work

The city engineer of Ogden, Utah, Joseph M. Tracy, shows his appreciation of the importance of giving contractors plenty of time to study plans and conditions before submitting bids, and of reaching all who would be likely to bid by announcing the work through the columns of a paper read by contractors. The city is to let a contract for about six miles of 42-inch to 60-inch sewer, and the legal notice will be published in a few weeks in one of the local papers. But advance notice is given in our advertising pages that the plans are now ready and can be examined. Incidentally, contractors will be paid in cash—as they always should be, but a few cities still follow the undesirable practice of making payment in paper that the contractor must discount.

The same excellent judgment was shown by the water department of Columbus, Ohio, which about a month ago gave notice that bids would be received in about two months for enlarging the water purification works and that plans were then ready, but that the legal advertisement would appear in the "City Bulletin" only.

Cities that give only a few days' notice in local papers of extensive contract work are almost sure to suffer financially in consequence. The bidders will probably be confined to local contractors who have had earlier information and who, in the absence of outside competition, will probably not sharpen their pencils very fine in estimating, or if there are bidders who have not had previous information about the work, they will bid high enough to cover incompleteness of investigation, or if they bid low are likely to be of the irresponsible kind that too often end in financial disaster to themselves and long delays and lawsuits for the city.

New York Loses Passaic Valley Sewer Suit

For thirteen years the city of New York has been fighting the Passaic valley sewer in the courts. Early in May a decision was handed down by the United States Supreme Court refusing the city's application for an injunction to prevent the building of the sewer. This sewer is being built to intercept the sewage now reaching the Passaic river, which is estimated at about 360,000,000 gallons a day, and to discharge the same through a long subaqueous outlet into the upper bay of New York harbor.

At the outset the United States took part in order to protect the federal interests in the harbor, but withdrew on receiving a stipulation from the Passaic Valley Sewerage Commission that it would construct a purification plant on the Newark meadows, this plant to consist of coarse screens, grit chambers, self-cleansing mechanical screens having clear openings of not more than .4 of an inch, followed by final clarification in sedimentation basins. These basins would be 225 feet long and have a capacity such as to provide a detention period of not less than one hour at the maximum rate of flow of the sewage and of not less than one and a half hours on the daily average flow, with mean lineal velocities through the tanks of not over 0.5 inch and 0.75 inch, respectively; the basins to contain scum boards and devices for removing the retained scum and deposits. The sewage so clarified was then to be pumped under pressure through a tunnel to a point in New York bay near Robbins Reef light, where it would be discharg d through outlets 40 feet or more beneath the surface, there being not less than 150 outlets located in four or more discharge pipes extending across the current and spaced about 100 feet apart, the outlets being not more than one foot in diameter and arranged to discharge horizontally across the tidal current; the outlets covering a dispersion area of at least 3.5 acres. The commission also agreed that, through use of the plant just described or other provisions that might prove necessary, the Passaic Valley sewage would not be permitted to cause any visible suspended particles in New York bay, or deposits objectionable to the Secretary of War, or odors due to the putrefaction of organic matter, or any grease or color on the surface of the bay, or injury to the public health, or injurious effect upon the property of the United States situated on the harbor of New York, or reduction in the dissolved oxygen contents of the waters of the bay to such an extent as to interfere with major fish life. Also that the United States should at all times have full opportunity to inspect the sewer system with a view to determining whether the contract is being performed.

This stipulation was objected to by New York City on the ground that it would be impossible to show whether any pollution of the harbor was due to Passaic Valley sewage or that from other sources, and it continued the fight in the courts. The Supreme Court in its decision holds that the stipulation with the United States is sufficient to prevent pollution of the harbor, but, in case such pollution should occur, it gives permission to New York to make another appeal for an injunction.

The court stated that, considering all of the evidence submitted, it failed to be convinced that "the sewage which the defendants intend to discharge into upper New York bay, even if treated only in the manner specifically described in the stipulation with the United States government, would so corrupt the water of the bay as to create a public nuisance by causing offensive odors or unsightly deposits on the surface, or that it would seriously add to the pollution of it."

The court makes a pertinent suggestion for co-operation in the following words: "We cannot withhold the suggestion inspired by the consideration of this case that the grave problem of sewage disposal presented by the large and growing population living on the shores of New York bay is one more likely to be wisely solved by co-operative study and by conference and mutual concession on the part of representatives of the states so vitally interested in it than by proceedings in any court, however constituted."

The Passaic Valley sewer is now practically completed, including the purification plant, except for the outlet into the harbor. Two contracts have already been let for this and abandoned by the contractors and it is a question when the outlet will be completed or whether it ever will be, and how great the cost will be. Undoubtedly the cost will be very much larger than was originally estimated. This entire outlet could be eliminated by discharging the sewage into Newark bay, and if the sewage were sufficiently purified this should cause no objectionable results. However, the dilution capacity of Newark bay is by no means so great as that of New York bay, since there is very little change of water due to tides, and the currents through it caused by tributary streams are not great.

One of the arguments used by New York was that if no nuisance would be created, New Jersey might discharge the sewage into Newark bay, against which New York could not object. It is possible that the difficulty and expense of the outlet may still cause the commission to adopt this plan, temporarily at least, leaving it to the future to decide whether, if Newark bay should show injurious effects from this discharge, the remedy should be a further purification of the sewage or the construction of the outlet into New York bay.

On the other hand, New York is asked to answer the question why she herself should not be called upon to treat the sewage being discharged from New York into the bay, which is many times that to be brought by the Passaic Valley sewer and which has already driven from the harbor all of the major fish life which the Passaic Valley Commission stipulated with the United States that it would not interfere with.

The suit has been very expensive, having cost New York more than $152,000, including employing the present Secretary of State, Charles E. Hughes, to represent it before the Supreme Court, while George W. Wickersham, formerly Attorney General of the United States, argued for New Jersey. The testimony taken amounted to about 2,500,000 words and 260 exhibits were put before the court. The printing cost New York $20,000, there being 12 large volumes of text, maps and diagrams.

This probably terminates any legal delays to the completion and use of the Passaic Valley sewer, which has been under construction for so many years. In addition to the engineering and financial questions already referred to, there still remains to be settled whether or not certain of the smaller communities in the Passaic Valley will utilize this sewer and join in paying for it. When it finally comes into use there will probably be considerable disappointment among those who expect to see the Passaic river returned to its original purity and transparency. There are many feet of sewage mud in the bottom of the river which will continue to putrefy for some time to come, and in addition to this, the sewer will not intercept from the river the discharges from many silk mills which contain spent dyes and other impurities that will continue to keep the river dark-colored even though they do not endanger the health of the communities lower down by contributing pathogenic germs or putrescible matters.

The Earth Concrete Road

A new variety of road is offered to highway officials, having first been brought to public notice at the Road Builders' show in Chicago this year. It is known as "earth concrete." A demonstration section of road was laid just outside of Grand Rapids last July. The process calls for mixing five parts of clay, sand, gumbo, muck or soil free from vegetable matter, which must be pulverized, with one part of Portland cement. The water used has dissolved in it 4 ounces of a chemical called "earthcrete" for each sack of cement, sufficient water being used to moisten each particle of the batch. This is laid like concrete, but is allowed to set longer than is customary for concrete. It is recommended especially as a substitute for concrete as a base for brick, asphalt or other wearing course, although the section laid near Grand Rapids is subjected directly to the wear of traffic. A sample of this road was cut out and sent to the Structural Material Research Laboratories of Lewis Institute, Chicago, where a compression test was made of 5 small blocks that were made from the sample, with the result given in the following report:

STRUCTURAL MATERIAL RESEARCH LABORATORIES
Lewis Institute, Chicago, Ill.

COMPRESSION TESTS OF EARTH CONCRETE, TAKEN FROM KNAPP ROAD,

Grand Rapids, Kent County, Michigan Lot No. 5035

Four small blocks were made and tested in a 40,000-lb. Riehle testing machine; one larger block was crushed in a 200,000-lb. Olsen testing machine.

Ref.	Dimension	Height	Sq. In. Loaded Area	Total Load	Unit Load Sq. In.
No. 1	2.50x2.85	3.6	7.12	13,450 lbs.	1890
No. 2	3 x3.05	3.3	9.15	21,160 lbs.	2310
No. 3	2.75x3.05	2.9	8.38	14,350 lbs.	1710
No. 4	2.80x2.85	4.2	7.98	14,785 lbs.	1850
No. 5	6.40x7.3	4.3	46.8	111,300 lbs.	2380

Average of 5 blocks, 2,030 lbs.

April 14, 1921. **Correct (Signed) S. WALKER,**
Approved, Prof. in Charge of Laboratory.

On May 4, the test road mentioned was inspected by a party containing Alvah Brown, chairman of the Kent County Road Commission and president of the of the Earth Concrete Company; Rial V. McArthur, member of the Kent County Road Commission; O. S. Hess, engineer of that commission; E. J. Paas, superintendent of road maintenance of the county; and H. J. McKinley, secretary of the commission; also Clifford Paige, city engineer of Grand Rapids; L. H. Belknap, chief engineer, and C. E. Foster, district engineer of the state highway commission; and R. S. Greenwood, secretary-treasurer of the Earth Concrete Company.

WORK DONE DURING 1920 AND CONTEMPLATED DURING 1921 (Continued)

County and State	During 1920: Money spent for hwy. work	During 1920: Kind and amount of surface laid	During 1920: Amt. done by contract & by employees C—contract E—employes	During 1921: Money available for hwy. wk.	During 1921: Kind & amt. of surface to be laid	During 1921: Amount to be done by contract and by employees C—contract; E—employees
Oregon (continued:						
Polk	.....	16 hard surface, 10 gravel & ...	....	75,000	.....	.....
Sherman	31,000	1½ mac., culverts	all E	45,000	3 mac.	all E
Wheeler	225,000	175,000 dirt, 50,000 crushed rock	all C	200,000	100,000 crushed rock, 75,000 dirt	all C
Yamhill	700,000	14 conc., 11 bit.	110,000 E 590,000 C	350,000	grading, 18 conc.	102,000 E, state work C
Pennsylvania:						
Allegheny	.....	19,808 war.-bit.	....	.....	.....	.....
Armstrong	80,000	1 brick, 1 conc.	all C	1,450,000	20 conc.	all C
Bradford	.....	31,702 war.-bit.	....	.....	.....	.....
Centre	.....	23,208 war.-bit.	....	.....	.....	.....
Delaware	.....	47,265 war.-bit.	....	.....	.....	.....
Erie	455,044.44	con.	all C	1,000,000	46 conc.	all C
Monroe	600,000	13 conc.	all C	500,000	mac., 5 conc.	5 mac. E
Potter	50,000	conc.	all C	50,000	8 conc.	all C
Warren	120,000	3 conc.	all C	200,000	1½ conc.	all C
Rhode Island:						
Bristol	22,000	½ topeka, 2 gravel	all E	30,000	7 gravel	all E
Providence	3,000	none	....	3,000	75 gravel	all E
South Carolina:						
Greenwood	540,000	1 conc., 107 topsoil	a.l C	608,000	1 conc., 60 topsoil	168,000 maint. E, 440,000 C
South Dakota:						
Clay	40,000	dirt	4,000 C, rest E	.....	$50,000-60,000 dirt	all E
Codington	53,000	9 gravel, 8 earth	45% E 55% C	38,000	10 earth	all E
Corson	103,000	48 earth	15,000 E, 88,000 C	30,000	24 earth	all C
Custer	260,000	2 crushed granite	all E	300,000	.....	30,000 E, 10,000 C
Davison	120,000	10 gravel, rest dirt	all E	160,000	8 gravel, 25 dirt	8 C, rest E
Day	234,989.64	earth roads	80,614.06C rest E	175,000	28 gravel, earth	60% E, 40% C
Gregory	100,000	1 gravel, rest earth	60,000 E earth, bridge C	200,000	earth, clay or sand	70,000 E, 130,000 C
Haakon	90,000	1,000 dirt rd.turnpiked	all E	150,000	100 dirt, 10 gravel	all E
Hanson	90,000	$22,000 gravel hwy., 6 earthwork	all E	175,000	finish 1920 proj. dirt	all E
Jackson	160,000	8 grav., rest earth	earth moving C rest E	25,000	100 earth	nearly all E
Lincoln	278,000	20 gravel, bridges	grading & maint. E 226,000 C	380,000	25 gravel, maint. & grading	maint. & grad. E, grading for grav. & bridges C
McCook	72,000	gravel and dirt	36,000 E 36,000 bridgework C	200,000	25 gravel, maint.. bridge work	¼ E, rest C
Miner	150,000	11½ gravel, 54½ clay	clay E gravel C	42,000	75 clay	all E
Minnehaha	280,000	39 gravel	all C	350,000	45 gravel	10 E, 35 C
Perkins	70,000	earth	20,000 E, 50,000 C	20,000	earth	all E
Spink	130,000	earth	all E	100,000	earth	all E
Stanley	80,000	53 dirt	48 E, 5 C	70,000	20 dirt	10 E, 10 C
Tripp	180,000	earth	100,000 E 80,000 C	165,000	18 grading	10% E, 90% C
Union	182,000	18 gravel	all C	60,000	18 grading & gravlg.	all C
Walworth	140,000	dirt	40,000 E, 60,000 C	90,000	dirt	all E
Yankton	80,000	grading	all E	300,000	grading	20,000 E, 280,000 C
Tennessee:						
Bedford, Coffee and Moore	100,000	5,000 gravel, 36,000 mac.	all C	1,200,000	8 mac., 35 bit. mac.	all C
Benton	60,000	grading	all E	60,000	.....	all E
Coche	100,000	mac.	all E	50,000	25,000 mac., 15,000 grade, 10,000 mac.	all E
Giles	200,000	40 gravel, 5 grade	40 E, 5 C	600,000	60	40 gravel E, 20 bit. C
Greene	100,000	20 earth, 32 mac.	all C	470,000	51 mac., 113 earth	all C
Hamilton	250,000	4 conc., 15 chert	all E	300,000	8 conc.	all E
Lewis	60,000	graded earth	10 E, 15 C	30,000	20 earth	all C
Lincoln	none	none	....	370,000	15 miles	all C
McMinn	22,000	4 chert, repairs	all E	56,000	14½ conc.	all C
Monroe	40,000	12 dirt	all C	800,000	35 asp. pen., mac. & grading	all C
Tipton and Lauderdale	108,225	13 grading	all C	328,918	13 bit. mac.	all C
Texas:						
Arkansas	38,000	10 sand clay, 25 earth	all C	62,000	25 shell surfacing	all C
Bosque	80,000	gravel	all E	60,000	10 gravel	all E
Callahan	120,000	none	20,000 E, 100,000 C	60,000	36 gravel	all C
Cameron	50,000	earth	all E	550,000	12 conc. pavement	all C
Carson	15,000	dirt	none E, little C	15,000	dirt	none E, little C
Colorado	330,000	35 gravel, 1 conc.	all C	50,000	4 gravel	all C
Dickins	86,983.94	14 gravel	all C	30,000	6.5 gravel	all C
Edwards	12,000	none	....	100,000	.....	all C
Fort Bend	60,000	grading	all C	200,000	$40,000 for grading, rest undetermined	all C
Gonzales	400,000	40 gravel	all C	277,750	12 mi. proj.	all C
Harris	400,000	2 conc., 15 mac., 5 bit. top.	all C	375,000	20 retreatment, repr.	all C
Johnson	200,000	gravel	all C	2,200,000	54 fed. aid	all C
Limestone	300,000	5 gravel, 90 grading	all C	1,000,000	55 gravel	all C
Madison	75,000	20 earth	all C	125,000	15 earth	5 E, 10 C
Milam	475,000	gravel	all C	410,000	all gravel	all C
Montague	300,000	44 gravel	all C	50,000	finish 1920 work	all C
Robertson	75,000	8 gravel	all E	.....	21½ Dixie Hwy.	all E
Rockwall	50,000	grading for conc.	all C	600,000	500,000 conc., 100,000 earth & bridges	all C
San Augustine	250,000	12 gravel	all C	300,000	21 gravel	all C
Shackelford	40,000	6 gravel, 10 earth	25,000 E 15,000 C	23,000	.....	.....
Tarrant	300,000	drainage structures & grading	15,000 E 285,000 C	3,775,000	2,000,000	500,000 E, 1,500,000 C

WORK DONE DURING 1920 AND CONTEMPLATED DURING 1921 (Continued)

County and State	During 1920: Money spent for hwy. work	During 1920: Kind and amount of surface laid	During 1920: Amt. done by contract & by employees C—contract E—employes	During 1921: Money available for hwy. wk.	During 1921: Kind & amt. of surface to be laid	During 1921: Amount to be done by contract and by employees C—contract; E—employees
Texas (continued):						
Trinity	30,000	.....	all E	500,000	20 grav., 50 sand clay	all C
White	10,000	mac.	all E	600,000	mac.	all C
Wise	160,000	17 rock and gravel, 17 earth, 4 clay	3 clay E rest C	130,000	2½ gravel, 23 drainage structures, 71 maint.	maint. E, rest C
Utah:						
Pleasant	.....	22,185 war.-bit.	....	.....	.....	.....
Salt Lake	.....	142,776 war.-bit.		.....	.....	.....
Vermont:						
Bennington	196,638	.3 conc., 5.2 gravel 1.4 conc. base w. asp.	gravel town rest C	372,000	5 conc., 13 gravel	6 gravel towns, rest C
Orange	117,000	2½ bit. mac., rest gravel	82,000 E 35,000 C	50,000	gravel	all E
Windham	92,000	gravel	62,000 E, 30,000 C	.....	.....	.....
Virginia:						
Augusta	150,000	8 mac.	75% E 25% C	450,000	23 mac.	50% E, 50% C
Brunswick	130,000	40 soil	40,000 E 90,000 C	80,000	20 soil	all C
Campbell	200,000	20 soil, 5 mac., 5 bridges	all C	346,000	59 soil, 6 bit. mac.	all C
Fairfax	43,000	mac.	all E	760,000	8 mac., possibly 23 more	all C
Nansemond	300,000	5 conc., 15 sand clay, 15 gravel	5 conc. C rest E	200,000	4½ conc., 10 sand clay & gravel	10 E, 4½ C
Scott	150,000	mac. & gravel	90,000 E 60,000 C	300,000	.....	175,000 E 125,000 C
Washington:						
Adams	1,000,000	86 gravel & rock 33 dirt	7½ E 78½ C	530,000	24.5 crushed rock	all C
Benton	.....	10 mac.	3 E, rest C	70,000	25,000 fills & mac. top	all E
Clallam	230,000	gravel	50,000 E 180,000 C	190,000	gravel	10 E, 12 C
Clarke	1,000,000	16 conc., 13 bit.	all C	315,000	7 conc.	all C
Grant	220,000	50 gravel	23 E, 27 C	300,000	60 gravel	24 E, 36 C
Island	39,350	4 gravel	1½ E, 2½ C	46,500	2½ per. hwy., 6 grav.	6 E, 2½ C
Jefferson	90,000	46,000 gravel	4,000 E, 42,000 C	98,000	40,000 gravel	1,500 E, 38,500 C
Kittitas	.....	27,070 sq. yds. conc., 1.2 mac.		.....	6 mac.	.....
Lincoln	601,000	56 crushed gravel	141,000 E rest C	261,000	23 grading & gravlg.	11 E, 12 C
Okanegan	125,750	10 grading & graveling, 17 graded, 2 bridges	17 grad. E rest C	150,000	12 grading & gravlg.	all C
Pierce	.....	18,814 war.-bit.	....	.....	.....	.....
Snohomish	600,000	300,000 conc., 300,000 gravel	200,000 E 400,000 C	725,000	350,000 conc., 100,000 brdg., 275,000 grav.	150,000 E 575,000 C
Wahkiakum	4,037	crushed rock	all E	3,553	Ocean Beach Hwy.	all E
Yakima	.....	117,740 war.-bit.	....	.....	.....	.....
West Virginia:						
Boone	255,754.82	grading, draining & bridges	25,000 E rest C	300,000	grading, draining & bridges	all C
Brooke	338,000	6½ mac., 2 conc., 12 grading, 3 base	rest C 3 grading E	320,000	¾ conc., 10 bit. mac.	¾ conc. C, rest E
Cabell	100,000	1 grading, ½ conc. 2½ brick	all E	.....	.....	.....
Calhoun	35,000	grading & drainage	all C	.....	25,000	all C
Hardy	35,000	gravel, mac.	all E	40,000	6 surface treatment, 5 gravel mac.	all E
Kanawha	.....	1.5 conc.	....	.....	14 conc., 4 mac.	.....
Mercer	170,000	8 grading	all C	100,000	6 grading, 3 bit. mac., reconst.	maint. E, grad. C
Mineral	151,006	21.000 sq. yds. mac.	all E	121,000	11 grading	all C
Morgan	79,000	1 1-3 conc.	all C	116,000	18 earth	all E
Nicholas	78.767 67	10 earth	all E	20,000	little	all E
Ohio	268,000	1 brick or conc., 3 mac.	mac E rest C	Indef.	.....	all C
Pocahontas	90,000	1½ mac., 10 grading	all E	120,000	grading	all E
Randolph	200,000	5 conc., 3½ tarvia, 1½ mac.	tarvia, mac. E conc. C	250,000	10 mac.	all C
Summers	170 210	1.9 pen. mac., bridge	surfacing E rest C	275,500	20 grading	5 E, 15 C
Taylor	none	.....	....	300,000	13 hard surfacing	all C
Wayne	654.193.78	2 brick, 46 earth	all C	400,000	.....	maint. E, rest C
Webster	50,000	earth	40,000 E, 10,000 C	150,000	grading	all C
Wetzel	215,000	1¼ conc.	all E	300,000	9 grading, 5 hard sur.	Indef.
Wisconsin:						
Adams	50,000	6½ clay	2 E, 4½ C	75.000	10 clay	3 E, 7 C
Bayfield	101.265.73	6 sand surfacing	all E	311,000	$300,000 sand surfac.	all E
Calumet	165,000	4 conc., 4 mac., 3 gravel	4 conc. C rest E	300,000	5 conc., rest mac. & gravel	5 C
Dunn	30,000	gravel	15,000 E, 15,000 C	200,000	4 conc., clay & gravel	20,000 E, 160,000 C
Forest	153 000	dirt	all E	257 945.46	dirt, gravel	.....
Grant	165,000	9 gravel, 1 mac. ¾ tarvia mac.	all E	500,000	grading & draining	150,000 E, 350,000 C
Iron	70 000	4 gravel	40,000 E, 30,000 C	147,000	8½ gravel	all E
Jefferson	.....	20 gravel	18 E, 2 C	350,000	15 conc., 15 gravel	gravel E, conc. C
Juneau	80 000	20 clay	1 1-6 C. rest E	90,000	clay, gravel	all E
La Crosse	255 840 37	15 bit.	all E	325 311.84	30 pen.	all E
La Fayette	130,000	earth	90,000 E 40,000 C	200.000	24	all E
Lincoln	120,511.36	gravel & grading	100,500 E 20,000 C	150,000	gravel & grading	100,000 E, 50,000 C
Natrona	541,000	1 bit.	....	225,000	.....	25,000 E
Portage	145.200.87	17 granite, 23 gravel	all E	294,000	6 conc., 24 gravel	24 E, 6 C
Riverside	65.798.92	4.6 mac., 1 conc.	3.8 C	157,054.52	.....	2 E, 4 C
Sauk	190,000	6 lime rock, 16 gravel	all E	235.000	18 lime rock, 9 gravel	all E
Trempealeau	450 000	gravel & mac. grading	100,000 E 250,000 C	350,000	175,000 grading, 75,000 gravel surfacing 50,000 mac.	most C

WORK DONE DURING 1920 AND CONTEMPLATED DURING 1921 (Continued)

County and State	During 1920: Money spent for hwy. work	During 1920: Kind and amount of surface laid	During 1920: Amt. done by contract a by employees C—contract E—employees	During 1921: Money available for hwy. wk.	During 1921: Kind & amt. of surface to be laid	During 1921: Amount to be done by contract and by employees C—contract; E—employees
Wisconsin (continued):						
Vernon	223,000	3 bit.	all E	250,000	3 bit.	all E
Waushara	65,000	gravel	45,000 E 20,000 C	135,000	19 gravel, ¼ conc.	85,000 E, 50,000 C
Wyoming:						
Weston	50,000	40 earth	20 E, 20 C	85,000	10 gravel, 150 earth	earth E, gravel C
Arkansas:						
Washington	350,000	gravel only, 80 grade, 20 finished road	none E 80 C	500,000	100 gravel	all C
California:						
San Benito	123,938	(a) 8 surfacing with oil & screening, 5 W. B. mac.; 3 oil bound mac.	13 E 3 C	150,000	.....	all C
Colorado:						
Fremont	70,000	25 gravel	all E	164,843	12 gravel	10 E, 2 C
Lake	10,000	5½ gravel, bridge	all E, except bridge C	6,160	maint.	all E
Delaware:						
New Castle	500,000	conc. & bitoslag	all C	500,000	.....	all C
Idaho:						
Benewah	140,000	none	80,000 E, 60,000 C	165,000	8 mac., 10 dirt	2 E, 18 C
Washington	.....	.....	....	.....	35 miles	all C
Indiana:						
Hendricks	300,000	4 1/6 conc., 6½ mac., 6½ grav.	all C	350,000	3½ gravel, 7 mac.	all C
Martin	50,000	mac.	all C	Indef.	15 stone	all C
Orange	50,000	mac., $20,000 bridges	all C	150,000	mac.	all C
Spencer	85,000	13 gravel	all C	800,000	.....	all C
Iowa:						
Jasper	114,000	$42,000 earth	all C	400,000	$150,000 earth, $50,000 gravel	200,000 C
Kansas:						
Butler	200,000	dirt	....	200,000	.....	....
Clark	28,500	earth	all E	24,000	4 clay on sand, rest maint.	all E
Kentucky:						
Carroll	2,000	.....	all E	.....	5 gravel	all E
Massachusetts:						
Middlesex	12,000	asp. mac.	....	4,000	asp. mac.	8,000 ft. C
Michigan:						
Washtenaw	500,000	1½ conc., 2¼ asp., 11 gravel	all C	1,000,000	16 conc. 23½ gravel	16 E, 23½ C
Minnesota:						
Martin	181,977	.....	....	150,000	17 earth, 10 gravel	11 earth, 10 grav. E, 6 earth C
Pine	188,125.44	31 grading, maint. & repair	28 E, 3 C	77,779.09	10 grading & gravel surfacing, 2 grading	all C
Wadena	40,000	.....	$30,000 E, $10,000 C	85,000	1-2 sand clay	most E
Mississippi:						
Lee	334,620	grading bridges & culverts	all C	.....	paving	all C
Missouri:						
Perry	18,000	3 rock & gravel	all E	24,000	rock & gravel	all E
New York:						
Saratoga	60,000	14 gravel, 2 bottom course for bit. mac.	all E	.....	$75,000 bit. macadam, gravel & concrete	all E
North Carolina:						
Cherokee	.....	.....	....	400,000	Indef.	Indef.
Macon	none	.....	....	800,000	.....	....
North Dakota:						
Foster	2,644	6½ graded road	all C	.....	10 grading	all C
Hettinger	200,000	dirt	65,000 E, 135,000 C	Indef.	mostly blade work	small amt. E, nearly all C
Williams	50,000	70 earth	most E, 4 C	100,000	73 earth	60 E, 13 C
Oregon:						
Washington	612,000	30 earth, 37 mac., 7 bit.	7 C, rest E	763,000	6.7 bit., 30 mac., grad.	rock quarries only C, rest E
Pennsylvania:						
Susquehanna	.....	.....	....	180,000	5 conc.	all C
Wyoming	none	none	none	.....	10 conc.	all C
South Dakota:						
Beadle	250,000	63½ grading, 39¼ fills, 2½ gravel, 46¾ rebladed	all E	533,000	50 grading, 75 reblade work, 20 gravel	all but fed. aid E, fed. aid C
Sully	35,000	$20,000 earth, $15,000 gravel	all E	85,000	800,000 earth, 5,000 gravel	35,000 E, 50,000 C
Texas:						
Comanche	60,000	8 earth	6½ grading C rest E	375,000	25 gravel, 28 grading & bridging	all C
Hill	1,000,000	gravel	all C	1,500,000	gravel & bit. surface	all C
Virginia:						
Pittsylvania	300,000	90,000 conc., 105,000 soil, 25,000 bit. mac.	all C	230,000	4 bit. mac., 20 soil, maint.	all C
Washington:						
Pacific	345,000	66,000 cem. conc., rest grading and draining	all C	352,000	5 cem. conc., 17 grav. & grading	all C
Skamania	52,000	3 mac.	all C	190,000	4 miles	all C

a During 1919 and 1920.

American Bids asked for $30,000,000 Work in Australia

Premier John Storey, of New South Wales, who is in this country, announces that American contractors will be asked to bid on a subway system for railway, tramway and vehicular traffic to cost $30,000,000. The government is also planning to build a bridge across Sydney harbor which will cost $15,000,000.

Both of these contracts should appeal to American contractors and be especially advantageous to them on account of their international preeminence in bridge construction and their unapproached successful experience in difficult subway construction.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

What Are the Best Methods of Handling Gravel from Car to Concrete Mixer?

By gravity alone, when conditions are favorable. By mechanical equipment and gravity combined or by mechanical equipment alone. Clam-shell, orange-peel and even drag-line buckets, derricks, gantries, locomotive cranes, belt and bucket conveyors, elevated bins, dump cars and chutes, are most common items of plant installed. Small amounts can be handled entirely by hand.

When large amounts of gravel to supply concrete mixing machines are delivered by railroad cars the most satisfactory and desirable method of unloading the cars is generally closely related to the method of storing the gravel after it is unloaded and of measuring it and delivering it to the concrete mixer, most rapidly, conveniently, and economically.

As in many other construction problems, some of the most important considerations are the amount of material to be handled, the speed required, the permanency or temporariness of the work, relative cost of hand labor, the cost and efficiency of hand labor, availability of mechanical plants and the ability to make the necessary investment to secure the greatest ultimate economy.

It may be cheaper to handle a comparatively small amount of material at a very high unit cost without any permanent installation, than to handle the same amount of material at a low unit of cost for direct operations plus a heavy cost for installation of plant that will not be useful or saleable after the completion of the given work.

Intermittent operations, limited progress, conflicting interests or other reasons may also make it much more advantageous to adopt certain methods and plants that involve a direct high unit cost or even a high total cost, rather than others that may show considerable economy regarding the gravel itself and yet involve objectionable features in connection with other parts of the work. These considerations must be carefully studied and balanced for any particular case.

The suggestions which follow refer solely to the intrinsic merits of various features of established practice which must be selected and applied in accordance with the circumstances and local requirements. The facts referring to gravel apply in large measure to broken stone and sand and in some degree to coal. They do not apply to cement because it must be carefully handled and scrupulously protected against moisture.

GRAVITY METHODS

The ideal method of unloading, storing and handling gravel would be its delivery in bottom dump cars, hauled on a track at the top of a steep bank or incline or on a trestle that would enable it to fall without guidance or to be chuted into an elevated storage bin or to storage behind a bulkhead on an inclined surface thus permitting the gravel to be drawn by gravity through a gate at the bottom of the bulkhead.

From storage the gravel should be spouted through a valved chute to the mixer and there discharged into measuring boxes or into the gauged charging hopper itself, and from it delivered to the machine. If the gravel cannot be chuted directly from storage to mixer it may be delivered at storage to batch boxes, buckets, measuring cars, or dump cars on an incline where the loaded cars pull back the empty ones and carry the gravel a considerable distance to the charging hopper of the mixing machine.

In some cases it might be good policy to use an all-gravity installation even if it resulted in the location of the concrete mixer at an elevation below all or a portion of the work so that it became necessary to hoist the concrete to the top of a tower and thence spout it to position.

COMBINED GRAVITY AND MECHANICAL INSTALLATION

Gravel delivered in dump cars may be unloaded by gravity without any mechanical appliances whatever, no matter whether they are dumped at a high or low elevation relative to the position of the concrete mixer and the ultimate storage pile. When it is not dumped at an elevation and position enabling the gravel to flow by gravity to storage as already described, it can be handled from the dump to storage by mechanical appliances and afterwards be delivered from storage to the mixing machine by gravity or by mechanical equipment. It will usually be economical to arrange the elevation and position of the storage so as to make all of the subsequent transfers to the concrete mixer by gravity alone.

If the gravel is dumped into a track pit or hopper or into piles of limited dimensions temporarily

stored alongside the track it can be transferred from this temporary position to the storage bin by belt or bucket conveyors, by excavating buckets operated by derricks, gantries, or their equivalents, by loading machines, by loading machines and dump cars combined, by locomotive cranes or traveling derricks.

Excavating machines of various sorts, especially the lighter ones may be adapted to handling the gravel in this case. These machines, loading machines and the conveyor machines will operate only in the storage yard and are not available for directly unloading the cars. The other methods are also available for unloading the cars and for filling adjacent storage bins at the same time and therefore will be here considered only in relation to the unloading of the cars.

UNLOADING CARS

If the cars are not dump cars or if the track is not elevated above the top of the storage pile or has not a hopper underneath it will be necessary to unload the gravel by scooping it out of the car. For small quantities or in emergencies this can always be done by men with shovels, an operation which is slow and costly at best and particularly so in very small cars or with gondola cars having high sides, especially if it is necessary to deliver the gravel to a single truck or other small receptacle, thus limiting the number of shovelers.

When hand shovelers are necessary it is often advantageous to use shovelers' chutes, which are simply inclined troughs supported on the edge of the car side and a trestly or other convenient support at the opposite end, thus carrying the gravel away from the car and delivering it into the truck in a convenient position or to a storage bin clear of the track. Convenient steel unloading chutes are to be had in the market and home-made chutes can also be easily provided if necessary.

For unloading a large quantity of gravel from non-dumping cars mechanical apparatus should be provided and usually consists of some sort of a scoop or bucket operated by a hoisting tackle suspended from a boom, elevated support or some sort of movable carriage, so as to have command of a sufficiently wide area to enable it to deliver to permanent storage or at least to a reloading bin, from which, if necessary, it can be spouted to cars or trucks for further transportation.

A desirable arrangement is to have the same bucket deliver to an elevated storage bin of moderate capacity and also to a surface storage pile where the gravel can be deposited when the bin is full and from which it can be reclaimed by the same bucket to fill the bin as it is emptied. The storage pile should, in any event, be located so as to be commanded by the same bucket that operates from the car and if the storage bin cannot be commanded by the same bucket another one may be provided to fill the bin from the storage pile.

BUCKETS

There are on the market various types of steel automatic buckets that fill themselves without shoveling, such as the clam-shell, orange-peel, grab bucket and even the drag-line or scraper bucket, that are suitable for handling the gravel. Clam-shell buckets are the simplest, and usually the most desirable and convenient. The drag-line bucket can reclaim the gravel from the storage pile, but can hardly remove it from an ordinary car. Most of the ordinary types of buckets can be purchased in sizes varying from ¼-yard to 2-yards capacity; the ½-yard, ¾-yard and 1-yard are suitable for ordinary light to heavy work, and are also available for ordinary excavation and other transportation purposes besides handling gravel.

If necessary an ordinary wooden or steel bucket may be used when excavating buckets are not available. It can be filled by shovelers stationed in the car and may be emptied by tilting or through bottom-flap doors. The tilting bucket may be operated by a hoisting engine winding up a dump line at a fixed time, or they may be balanced so as to tilt by gravity when unlocked. The bottom-flap buckets are, of course, dumped by releasing the latch either by a hand line or by a stop fixed to operate at a given point.

OPERATING BUCKETS

The buckets can be operated from derricks, locomotive cranes, A-frames, gantries, ginpoles, or even from cableways. Simple A-frames, ginpoles and gantries of a home-made type can be very easily provided, but have a limited radius of operation, especially the A-frame and gantry that provide for a very short horizontal movement of the bucket and that only in a limited direction. For the small amount of gravel that alone would justify the use of these appliances it might be suitable to operate the bucket lines by a hand windlass or crab, but in general a regular hoisting engine or a drum operated by a belt or by a steam, gasoline, electricity or compressed air motor should be provided.

Either guyed, stiff-leg or traveling derricks may be used, according to circumstances and requirements, but ordinarily stiff-leg derricks will be more convenient and efficient for handling a large quantity of material at a given point. The derrick boom should be long enough to serve the top of a conical storage pile having a volume as great as the required amount of storage and to also serve the elevated storage bin or else more than one derrick should be installed or a movable derrick employed. The capacity of the boom need not, however, be more than 5,000 pounds at full radius, unless a bucket of more than 1-yard capacity is used.

Derricks are so universally used for all kinds of building and construction operations that it will generally be possible to secure one in the vicinity, or to purchase one from the manufacturer without much delay or expensive transportation, but it is also practicable to purchase the derrick fittings and rig them to mast and boom made of square timber bought at the nearest lumber yard or even to round timber cut near the site.

Simple derrick fittings can be forged by a country blacksmith and finished in an ordinary machine shop and commercial pulley blocks may be rove with either steel or manila rope if it is

necessary to improvise a home-made derrick, in which case care should be taken to make all parts of excess strength. In most places the masts and booms from 25 to 50 feet long can easily be secured of sufficient diameter and quality to be perfectly safe for ordinary service. A long boom up to 80 or even 100 feet can be made by splicing and trussing shorter timbers, but this should not be attempted unless under urgent conditions and by experienced derrick designers.

A small amount of work involving only short distances, can be satisfactorily performed with jinniwink derricks which are simply small, portable stiff-leg derricks, usually of wooden construction, with booms about 25 feet long and up to 5 tons capacity, operated by hand power or small engines and easily knocked down and shipped from place to place by railroads or trucks, and when in service quickly shifted by skidding on its sills. Any stiff-leg derrick can be made movable to command a long storage pile or to be shifted from the storage pile to the storage bin by mounting the sills on three trucks, preferably having four wheels each, and operated on two parallel tracks, although it is possible to use trucks having only 1 or 2 wheels each and in the same line and running on two rails, making one broad-gauge track instead of two standard or narrow-gauge tracks. In either case one truck must be placed under the foot of the mast and ballast must be loaded over the other trucks to provide counterweights and fixed stability to the derrick in service. A platform is usually built on the sills over the rear trucks to carry the hoisting engine and boiler which thus serve as part or the whole of the required counterweight.

(To Be Continued)

Care of Concrete Mixers*

In most cases the operators of concrete mixers are fully responsible for the upkeep of the machines and are never called to task because the mixer is in run-down condition. If the contractors themselves or a responsible foreman would see to it that their mixers were properly greased, oiled, cleaned, etc., there is no doubt that the mixer's life and efficiency would be materially increased.

Setting Up.—When you buy a mixer, see that it is assembled correctly before starting. Turn down the grease cups, oil the wearing surfaces where necessary, see that the bolts and nuts are tight and be sure everything is all right, then go ahead. Manufacturers always send instructions for setting up, which should be your guide when assembling.

Oiling.—Oil your machine liberally. Give the drum rollers plenty of grease; they have the heaviest duty. Don't forget your engine, either; it needs oil. Follow the engine oiling instructions carefully. Oil the drive chains to make them drive smoothly and endure. Oil all gears, especially bevel gears. Use a good quality of machine oil that will not thicken when cold. Also use a good grade cup grease where grease is required.

Feeding.—It has been found that as far as mixing is concerned, it does not matter in what order materials are fed into the drum. The feeding is done to meet the convenience of the operator. If desired, the old method of hand mixing can be adopted as follows: Sand and cement, then add water and follow with crushed rock or gravel. A good way to get cement in without "dusting" is to put it into a barrow of sand, or still better, to add some water to the batch before putting in the cement.

Where a sharp stone is used in the batch, it is well to put in a portion or all the sand first, as the sand will act as a cushion and protect the shell of the drum. Do not fill the drum too full. A big batch mixes more slowly than a small one. There is a happy medium between best time per batch and best quality, which experiment will determine. Cement mortar or "sloppy" concrete is best mixed in batches of reduced size.

Washing.—Wash out the drum before the mixer is stopped. It is necessary to keep the inside of the drum clean, as only a clean drum will do good work. Fill the drum with water and revolve until it is clean, then discharge the water. If water alone does not clean drum, add a little crushed stone or a few small pieces of scrap iron. If the drum is once neglected and cement allowed to harden inside, it is very difficult to clean.

Blocking.—It is sometimes desirable to block mixers. Do this whenever possible. It not only prevents destructive vibration but saves power and repair bills.

Care of Boiler.—Do not fire hard when the boiler is cold. The type of vertical boiler best adapted to concrete mixers has one weak point, viz., the top ends of the flues are not surrounded by water. In raising steam, the fire should not be crowded until some pressure is shown on the gauge, or the top of the tubes will be overheated and the boiler will surely leak.

Repairs.—Keep your mixer repaired. Don't allow parts to be worn so they affect the operation of the mixer. The minute you notice a worn part order a new one. It will pay you every time. Particularly watch your drum rollers. Replace them as soon as they are worn or become wobbly. Never allow your drum to run untrue. Watch every part and replace it with new one as required.

*By L. P. Lessard, Sales Dept., the T. L. Smith Co., Milwaukee.

To Keep Oil Out of Sewers

City ordinances of Providence, R. I., already prohibit the dumping of highly inflammable materials into the sewers, which includes gasoline, but there seems to be no provision that covers heavy oils and some other objectionable substances. Large quantities of heavy oils are not only permitted to escape into the sewers, but are being actually dumped into them by both public and private garages. A new ordinance providing substantial penalties for those caught continuing this practice has been introduced into council and will probably be passed.

Recent Legal Decisions

CITY'S POWER TO CONNECT BY PAVING THE PAVED PORTIONS OF STREETS—ENGINEERING EXPENSES PROPERLY INCLUDED IN ASSESSING PAVING COSTS

In a suit to enjoin the city of Wichita, Kan., from levying a paving assessment the Kansas Supreme Court holds, Bailey v. Henrion, 194 Pac. 928, that under the Kansas statute (Gen. St., 1915, par. 1236) a city of the first class has power, upon its own initiative and regardless of the attitude of resident taxpayers affected thereby, to pave an intervening portion of a city street to connect portions already paved, if such unpaved portion does not exceed two ordinary city blocks in extent.

Another question was raised by the plaintiffs. Included in the cost of this paving improvement was an item of 5 per cent for engineering expenses. Aside from the physical work of excavation, construction and the furnishing of materials, there is a necessary expense of surveying, making blueprints, supervising the work as it progresses, and inspecting the materials used in making the pavement. Is this a proper charge in calculating the true cost of the improvement? This expense is called "engineering"; sometimes it is called "overhead." Whatever the name, the court holds it is a very necessary item of expenditure. "It would be a very costly economy, indeed, it would be absurd, to undertake an expensive work of paving construction without this 'engineering.' While the city may have an official engineer and pay him an annual salary, yet he cannot do all this work alone. He must have linemen, rodmen, and perhaps other employees, at the particular work or in his office, assisting him; and it must be held that a reasonable charge for this 'overhead' or 'engineering' is properly included in determining the cost of the improvement, and it is proper to take it into account in assessing that cost against the property benefited by the improvement."

ICE IN STREETS—PROPER CARE REQUIRED OF PEDESTRIANS

Action was brought against a city for injuries to a pedestrian who fell as a result of coming in contact with a large ridge of ice, three or four inches in thickness, which extended across the sidewalk and had been there for three weeks. The night was clear, the electric lights were burning brightly on the corner where the plaintiff fell, and the ridge of ice was visible for a considerable distance. The Pennsylvania Supreme Court, Gryning v. City of Philadelphia, 112 Atl. 448, reversing a judgment for the plaintiff, held the city not liable. While a pedestrian is only required to use ordinary care, it is his duty to keep a general lookout, so as to observe dangers directly in his path, and the plaintiff being a young man, with normal eyesight, and with no one near to obstruct his view or distract his attention, could not be heard to say that he was watching his way very carefully and did not see the ridge of ice.

ORDER TO DIRECTOR OF PUBLIC WORKS TO LAY OUT PROPER SEWER HELD NOT UNLAWFUL DELEGATION OF POWER

The public powers or trusts devolved by law or charter upon the council or governing body of a municipality to be exercised by it when and in such manner as it shall judge best cannot be delegated to others; but powers of a purely ministerial, administrative, or executive nature may be delegated to a committee or some appropriate officer. In a proceeding to set aside a sewer assessment, the Connecticut Court of Errors, Donnelly v. City of New Haven, 111 Atl. 897, points out that the correct application of the above rules to cases under specific municipal charters is not always easy. The municipal charter is a delegation of power from the legislative body of the state. Whatever is by such charter required to be done by the governing body of the municipality must, so far as that municipality is concerned, be deemed to be legislative in character, and can only be done by such governing body itself. Hence it is that many matters may be referred by a charter to the action of such municipal body which are really administrative or executive in their character. In a given case the generality or the detail of the power as set forth in the charter must be carefully examined and will furnish the guide as to what powers may and what may not be delegated by the governing body. Applying these principles, the court holds that, since Section 132 of the New Haven Charter merely provides that the board of aldermen is authorized to order, lay out, construct, repair, and alter public squares, parks, streets, highways, sewers, etc., an order that the director of public works cause a sewer to be constructed with specified termini of the proper size and materials, with the necessary manholes, etc., is not an unlawful delegation of legislative power, the charter containing no specific provisions as to sewers.

WASHINGTON COMMISSION CANNOT DENY CITY'S APPLICATION FOR RAILROAD CROSSING

On appeal by the Washington Public Service Commission from a judgment of the Yakima County Superior Court reversing its order denying a petition of the city of Toppenish for the establishment of a grade street crossing over the Northern Pacific tracks in that city, the Washington Supreme Court holds, State v. Commission, 194 Pac. 982, that under Sections 2 and 3 of the Grade Crossing Law, the Commission is without power to decide whether or not there shall be a crossing over a railroad track, but may only decide what kind of crossing shall be established; and where a city of the third class by its proper authorities decides, under its statutory power to lay out and establish highways, that a grade crossing should be established, it being found impracticable to establish an overhead or undercrossing, it is the duty of the Commission to permit the establishment of the crossing, if the action of the city council is not arbitrary or capricious.

NEWS OF THE SOCIETIES

May 23-26—NEW JERSEY STATE BUILDING TRADES COUNCIL. Atlantic City, N. J.

May 23-26 — AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Spring meeting. Congress Hotel, Chicago.

May 25-6—NATIONAL INDUSTRIAL TRAFFIC LEAGUE. Cleveland, O.

May 27—AMERICAN SOCIETY OF SAFETY ENGINEERS. Engineering Societies Building, New York City.

May 31-June 3—NATIONAL ELECTRIC LIGHT ASSOCIATION. Pasadena, Cal.

June 2-4—GOVERNMENTAL RESEARCH CONFERENCE. Philadelphia, Pa. Secretary, Dr. L. D. Upson, 542 Griswold st., Detroit, Mich.

June 5-16—TRI-STATE WATER AND LIGHT ASSOCIATION. Asheville, N. C. Secretary, W. F. Seitglitz, Columbia, S. C.

June 6-10—AMERICAN WATER WORKS ASSOCIATION. Annual convention, Hollenden Hotel, Cleveland. Secretary, J. M. Diven, 153 W. 71st st., New York City.

June 13-14—CLEVELAND SECTION AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Regional meeting, Great Lakes Territory. Hotel Statler.

June 14-16—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco.

June 15-17—LEAGUE OF MICHIGAN MUNICIPALITIES. Annual Convention. Kalamazoo, Mich.

June 17 — PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Outing at Howard McCall Field.

June 17—INLAND EMPIRE SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with engineering societies of Spokane.

June 20-24—AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting. Asbury Park, N. J.

June 28 — ATLANTA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Election of officers. Georgia School of Technology, Atlanta.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. Ne wYork City.

BROOKLYN ENGINEERS' CLUB

At the regular meeting, May 5, the paper of the evening on the "Erection of Long-Span Bridges," illustrated with numerous stereoptican slides was presented by Frank W. Skinner, who described the three principal types of erection, one or the other of which is used for all very long spans, namely, cantilever erection, suspended erection, and arch erection, which is virtually a modification of cantilever erection. A notable illustration of the three types of famous long spans co-existent in the Niagara Gorge was shown with the railroad arch bridge in process of construction on the site of the old railroad suspension bridge still in service and the cantilever bridge in the background.

The erection of the Quebec bridge spans, successfully completed after two great disasters, was described and illustrated with pictures of the anchor arm, cantilever erection and the building, floating and hoisting of the 600-foot center suspended span. The methods employed in the erection of the Washington Plate Girder Arch Bridge, a 510-foot span across the Harlem river, that was assembled on massive falsework, and of the erection with back stays of the 1,000-foot 4-track Hellgate arch bridge and of the 1,400-foot span 6-track Manhattan Suspension bridge from a temporary suspended cable platform were described and illustrated. The paper reviewed some of the greatest achievements in bridge engineering in which American engineers hold world supremacy, and emphasized the importance of the civil engineer in all of the great interests of finance, commerce, industry, transportation and manufacture, showed how engineering construction is coordinated with world safety and progress, and particularly indicated the worthy part played in it by many members of this club. At the May 12 meeting, Paper No. 175 entitled "City Surveying—for the surveyor and the examiner of land titles," was presented by Edwin P. Clark.

AMERICAN WATER WORKS ASSOCIATION

The program published May 14 on page 418 for the annual convention at Cleveland, June 6-10, has been considerably enlarged. A new feature to which particular attention is asked, is the informal meetings in small groups which will be arranged under the following heads or topics: 1. Office Methods, Records, Accounts, etc. 2. Pumping Station, Engines, Boilers, Firing, etc. 3. Filter Operation and Care. 4. Pipe Laying, Methods, Records, etc. 5. Services and Meters, Material, laying and setting, who does the work, who pays for, etc. 6. Water Sheds and Reservoirs, Their Care, Algae Treatment, Tree Planting, etc. 7. Private Fire Protection Services.

Members interested in any of the above topics will register at the Convention Office for assignment to the desired group.

The following additional papers are announced: "A Reservoir vs. Additional Pumping Equipment for Supplying Peak Demands," L. A. Quayle. *"Cleveland's Water System in Story and Picture," G. E. Flower. *"A Sanitary Survey of Lake Erie Opposite Cleveland with Reference to the Location of New Water Works Intakes," J. W. Ellms. *"Investigation for Causes of Obnoxious Tastes and Odors Sometimes Occurring in the Cleveland Water Supply," J. W. Ellms and W. C. Lawrence. "The Rate of Solution of Sulphate of Alumina, with Reference to the Design of Solution Tanks," J. W. Ellms and A. G. Levy. "Division Pumping Station, a Description of the Station and Its Operation," J. N. H. Christman. "Fairmont Municipal Heating Plant, a Description of the Largest Municipal Heating Plant and its Operation," H. W. Kaiser. "Baldwin Pumping Station and Heating Plant and Analysis of Certain Problems Involved in the Design of This New Pumping Station and Municipal Heating Plant," L. A. Quayle. "Overcoming Difficulties with Animalcules at the Dallas Filters," Helman Rosenthal. "The Education and Training of Water Plant Operators," Lewis O. Bernhagen. "Licensing Filter Plant Operators in New Jersey," Charles H. Capen, Jr. "A Method of Determining by a Single Flow Test of a Meter Its Capacity at All Pressure Losses," Fred B. Nelson. "Water Works Publicity," Scotland G. Highland. "Construction and Maintenance of a 6-inch Galvanized Wrought Iron Submarine Pipe Line," James W. Graham.

Chemical and Bacteriological Section, June 9, forenoon: "Coagulation and Sedimentation with Chemicals," J. W. Ellms. "Some Notes on Colloidal Chemistry as Applied to Water Filtration," Milton F. Stein. *"Application of Colloid Chemistry to the study of Filtration," Malcolm Pirnie. "Turbidimetry of Water," P. V. Wells, Associate Physicist, Bureau of Standards. "The Physical Chemistry of Iron Removal from Water," Robert Spurr Weston.

Afternoon, "Application of Colloid Chemistry to the Filter-Pressing of Sewage Sludge," John Arthur Wilson, Wm. R. Copeland and Henry Mills Heisig (Milwaukee, Wis., Sewage Commissioners). "Colloid Chemistry of Tank Treatment of Sewage," Langdon Pearse and F. W. Mohlman. "The Physical Chemistry of Chlorination of Water," George L. Clark. "The Reaction of Culture Media," George C. Bunker.

*Illustrated with lantern slides.

TWIN CITY CHAPTER, AMERICAN ASSOCIATION OF ENGINEERS

At a recent meeting of the Twin City Chapter of the A. A. E., the following officers were elected: President, Frederick Paul; first vice-president, S. E. Ganser; second vice-president, L. W. Chandler; third vice-president, Ernest Marshall; and fourth vice-president, A. E. Clearman. Walter H. Wheeler, consulting engineer of Minneapolis, addressed the meeting.

NATIONAL HIGHWAY TRAFFIC ASSOCIATION

The 1921 convention was held at Detroit April 29. Reports were received from committees on Regulation of Overloading of Motor Trucks; Traffic Center Lines on Roadways; Equitable Distribution of the Cost of Construction and Maintenance of State Highways; Status of the Construction of Highway Curves and Recommended Practice to Increase Safety to Traffic; Widths of Roadways and Sidewalks in Municipalities; Motor Bus Service for Consolidated Rural Schools; Highway Transport Clearing Houses; Highway Transport Franchises; Inter-relationship of Highway, Railway and Waterway Transport; Relative Efficiency of Different Types of Car Stop Safety Zones and Their Relation to Parking and Ranking Regulations; Segregated Traffic Streets in Municipalities; and on Regulations Covering Speeds, Weights and Dimensions of Motor Trucks and Trailers.

The officers for 1920-1921 are: President, Arthur H. Blanchard; vice-Presidents, David Beecroft, R. C. Hargreaves, L. A. Nares, Jack F. Witt; secretary, Elmer Thompson; treasurer, George H. Pride. Directors, W. T. Beatty, Roy D. Chapin, J. H. Collins, R. J Corbitt, Charles Henry Davis, J. D. Eggleston, William P. Eno, John Fields, T. D. Guthrie, R. E. Hines, Thomas B. King, P. A. Koehring, Samuel P. Leeds, Irving W. Patterson, T. Coleman du Pont, F. A. Seiberling, Tom Snyder, William C. Spear, Samuel W. Taylor, J. DeMont Thompson, F. W. A. Vesper, George F. Wolz. Executive committee, Arthur H. Blanchard, R. C. Hargreaves, George H. Pride, Tom Snyder, Elmer Thompson.

AMERICAN ASSOCIATION OF ENGINEERS

At the meeting at Buffalo, May 9-11, H. O. Garman was elected president of the American Association of Engineers. The other officers elected by the association are A. N. Johnson, vice-president; A. S. Morris, second vice-president; E. F. Ayres, Webster L. Benham, Garrison Babcock, Morris Bien, G. M. Butler and W. R. McKeen were elected directors.

The American Association of Engineers has 25,000 members and the convention at Buffalo was unusually well attended. Among the important things discussed were the utilization of technical knowledge in public service, and the adequate distribution of engineering ability throughout the country, leading to better utilization of engineering knowledge.

The association is devoting special attention to helping young engineers in difficult years when they are becoming established. In the work of the organization it is emphasized that the pay of engineers should be commensurate with their duties and responsibilities; and every engineer should recognize the duties and privileges of citizenship.

An adequate preparedness program was discussed, also the observation in the engineering profession of traditional rules of conduct. In the enonomic structure of the nation the engineering profession is held by the association to be the intermediary between labor and capital.

ENGINEERING DINNER TO HOOVER

Following the meeting of the executive board of the American Engineering Council of the Federated American Engineering Societies in Philadelphia, April 16, there was a well-attended dinner at the Bellevue-Stratford Hotel. The principal speaker was Secretary of Commerce Herbert C. Hoover, president of the Federation.

The dinner was given by the Engineers' Club of Philadelphia and its fourteen affiliated societies with a membership of more than 4,600 in Philadelphia and Eastern Pennsylvania. The presiding officer was Guilliaem Aertsen, of the Midvale Steel & Ordnance Co. and president of the Engineers' Club of Philadelphia. The toastmaster was Major Joseph A. Steinmetz, past president of the Engineers' Club and chairman of the Aeronautical Section of the American Society of Mechanical Engineers. Mr. Aertsen, as president of the club, presented to Mr. Hoover a certificate of honorary membership in the Engineers Club of Philadelphia. Following presentation Mr. Hoover delivered his address.

The other speakers were Dean Dexter S. Kimball, of Cornell University, vice-president of the F. A. E. S., who discussed "The Federated American Engineering Societies"; J. C. Trautwine, Jr., editor of *Trautwine's Handbook*, whose topic was "The Engineers of Philadelphia," and George Wharton Pepper, lawyer and publicist.

The meeting of the executive board of the F. A. E. S. considered several matters of great importance, particularly the assay of waste which is being conducted by the committee on elimination of waste in industry.

ROADS CONVENTION

The annual meeting of the United States Good Roads Association, the Bankhead National Highway Association and the United States Good Roads show took place in Greensboro on April 18-23. The most important event of the meeting was the resolution adopted to urge Congress to make an annual appropriation of $100,000,000 for the next five years to aid the states in building good roads, also to adopt a system of national highways throughout the United States.

The chief addresses of the meetings were the following: "Our Nation's Road Problem," by Thomas H. McDonald; "State System vs. County System of Hard Roads," by J. H. Scarborough; an address by United States Senator Lee S. Overman; "Road Building in the Southwest," by E. P. Toney; "Origin and Historical Development of Rock Asphalt," by W. F. Pollard; "Steel Forms for Good Roads," by Edward M. Ornitz; "Practical Road Building," by Frank N. Page, John Craft, Col. W. F. Whitemore, Boggs, Sid Smith, R. C. Morefield, S. W. Fallis and G. W. Coleman; and "Types of Roads," by C. M. Upham.

MONTANA SOCIETY OF ENGINEERS

The Montana Society of Engineers at its 34th annual convention on April 9 elected the following officers: President, George T. McGee; first vice-president, Chauncy L. Berrien; second vice-president, Leon D. Conkling; secretary and librarian, Earle B. Young; and treasurer, Harry H. Cochrane.

BUFFALO, N. Y., SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS

The Buffalo section, A. S. C. E., at its first annual meeting on April 5 elected the following officers: President, A. L. Johnson; vice-president, G. B. Bassett; and secretary-treasurer, B. L. Cushing.

INDUSTRIAL NOTES

LUMBER INSPECTION RULES

4¾ x 5⅝ inches, 340 pages, illustrated, flexible covers, rounded edges, price $3, Larson & Crouch, 280 Madison Ave., New York City. This attractive book is designed to fit in the outside coat pocket for greatest convenience for ready reference use. It is an encyclopedic compendium of data furnished by the principal lumber companies and representatives of standard lumber and timber interests in the United States. It is believed to be the first publication covering description, definition and lists of different lumber products with sizes, details of qualities, requirements, defects and rules for inspection and classification covering all or almost all of the commercial features of lumber and timber business. It will be found authoritative and convenient for the use of architects, engineers, contractors and designers writing specifications and making designs and bills of material.

The specifications of many important lumber dealers and associations are given in full for about 30 different species of timber and many more varieties. It contains general rules, classifications into the principal headings of flooring, boards, planks, dimension, stepping and rough edge, and is succeeded by many other specifications enlarging the list of classifications and including poles, shingles, mining timber, railroad ties, ship-lap and specials.

These are tables of official standard weights of hard wood lumber for different thickness per thousand feet, half tones showing characteristics of different kinds of timber, specific gravities, relative hardness, commercial sizes and lengths, tests for bending, compression and shear for green and seasoned timber.

General directions for grading timber, specific descriptions of defects and codes and terms are given. Under the heading "Patterns" there are 50 pages of dimensioned diagrams, showing the cross-sections of milled lumber.

TIMBER HIGHWAY BRIDGES

Standard specifications for Southern yellow pine bridge and trestle timber as adopted by the American Society for testing materials are published in a small pamphlet by the Southern Pine Association, Interstate Bank building, New Orleans, who will mail copies on request. By C. W. Caul, 79 pages, 6 x 9 inches, illustrated, paper covered, published by Engineering Bureau, Natural Lumber Association, Lumber Exchange, Chicago, price 15 cents.

This book has been prepared through the co-operation of state highway engineers and others and contains 8 chapters, including one on types of bridges, floors and wearing surfaces, joint and metal details, plans of timber highway bridges, and data regarding quality, preservation, and a bibliography. It has 26 illustrations, most of them full-page line cuts, showing general plans and details of long and short span trusses, substructures, floors, bracing trestle viaducts, and standard spans from 20 to 170 feet long. There are bills of materials for short span bridges.

COST OF HANDLING CONCRETE PAVING MATERIALS

A handsomely illustrated pamphlet issued by Barber-Greene Co., Aurora, Ill., on the cost data of Barber-Greene method of handling concrete paving materials, tabulations of classified cost of labor and supplies for executing six paving jobs where the contractors used Barber-Greene self-feeding loaders. These records indicate savings of $23 to $53 per day and are accompanied by diagrams of the plans and operations.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

DAKE ENGINES

Catalog 28 of the Dake Engine Co. illustrates standard engines, steam or air operated, for hoisting, swinging and miscellaneous power operations suitable for construction work and other purposes, operating with equal efficiency in any position, horizontal, vertical or inclined, giving them a wide range of adaptability and making them suitable for many styles of applications where no other engine can be used. The Dake is a double reciprocative engine with inner and outer pistons arranged to completely avoid a dead center, and in reversing to make the power as nearly equal as possible in both directions. It is practical to install this engine with reversing throttle removed and connected by air hose or pipe to allow distant control.

The engine occupies less space than any other type of equal power; is strong, durable and easy to install; starts instantly, does not require constant attention; does not endanger the safety of the plant or operator; and requires a minimum of upkeep, attention and maintenance per unit of power.

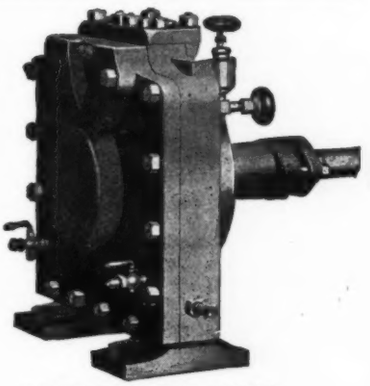
The different types described include air and steam engines, belt driven hoists, blowers, capstans, centrifugal pumps, chain hoists, single and double drum hoists, elevator hoists, crabs and winches, hoisting engines, pneumatic hoists, spud hoists, swinging gears, stationary engines, trolley hoists and a considerable variety of engines for special purposes, particularly in marine service.

The long and favorably known Dake swinging engine, which has been installed on a great number of construction jobs to operate derrick booms regardless of the type of hoisting engine used with them, is made in two types, one of which has a single lever for moving both engine and brake allowing quick and accurate dropping of the load and removing all stress or strain on gears when coasting the load. The other types of swinging engines are made in four sizes with horsepowers of 5, 10 and 15, speed of about 30 feet per minute, and with loads up to 3,000 pounds.

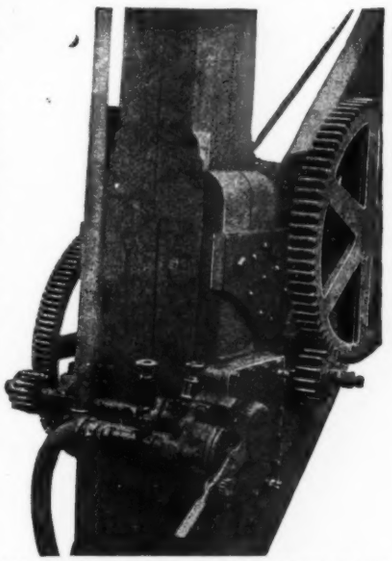
The adaptability of the Dake motor is illustrated by its use on the mast of a crane to convert it from a hand operated to a power operated tool. This is effected simply by removing the hand cranks and attaching the motor without changing the gearing.

The standard non-reversing type of air or steam motor is adapted for attachment to almost any machine or appliance not requiring reverse motion. It is made in ten sizes, being as small as ½ h. p. and up to 30 h. p. and weighs from 65 to 2,000 pounds. Corresponding reversing type weighs from 75 to 2,200 pounds.

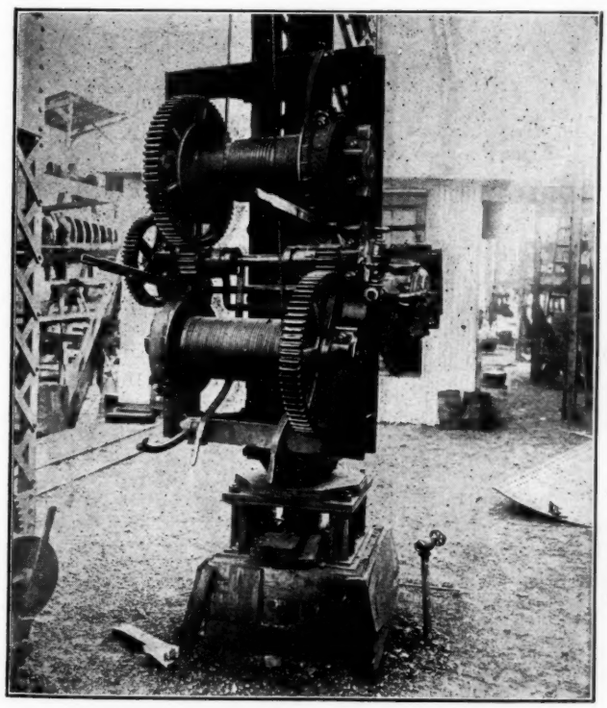
The single and double drum motor crabs for use on derricks and cranes are constructed with a rigid iron frame bolted to the mast and are fitted for use with steam or air. They are also constructed with pulley for belt drive. They are made in four sizes of 3, 5, 7 and 10 h. p., capacity varying from 1,000 pounds at a speed of



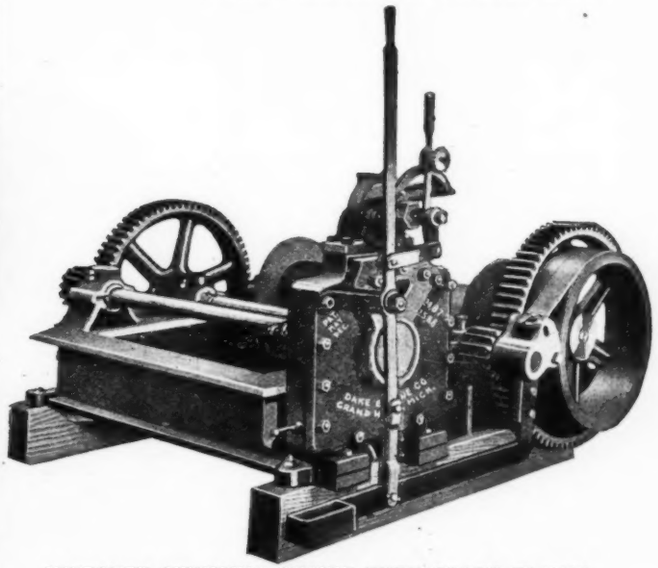
DAKE STANDARD MOTOR



MOTOR MOUNTED ON DERRICK MAST



DOUBLE DRUM REVERSING MOTOR CRAB



IMPROVED SWINGING ENGINE WITH BRAKE FLANGE ON DRUM GEAR

73, to 6,500 pounds at a speed of 38 feet per minute on a single line.

Hoisting engines are entirely without vibration and are built with single drum reversing and non-reversing single and double geared friction, double geared and belt driven hoists. Most of them are built in 5, 7, 10, 15, 20 and 30 h. p. sizes.

Elevator hoists operated by steam, compressed air or electricity are made with capacities of 2,500, 5,000 and 10,000 pounds at speeds of 50, 60 and 70 feet per minute for steam and are of 7, 15 and 20 h. p., speeds of 65 and 55 feet and loads of 1,500 and 2,250 pounds for electric power.

Electric crabs are made with single or double friction or clutch drums as required. They are bolted directly to the mast of the derrick and may be provided with a swinging attachment, having a vertical shaft that carries an inside pinion engaging the circular rack, by which the derrick is revolved.

SERVICISED JOINTS

The circular issued by the Servicised Co. describes several kinds of joints for pavements and concrete construction that are claimed to make better jobs than poured joints, cost less to install; save time, labor, material, inspection, and superintendence; insure uniformity; do not melt in hot weather; retain their elasticity in cold weather; absorb expansion, longitudinal and transverse stresses, and prevent rapid destruction of the pavement adjoining car tracks by absorbing the vibration of the rails.

The feather joint, type A (patent pending) is a light expansion joint constructed of a special waterproof and acid proof fibrous material which has a uniform or wedge shape section, will not ooze under compression, and is improved by traffic. It is made in all sizes from ½ inch in depth up to 12 inches. It weighs from 20 to 318 pounds for 100-foot lengths with cross sections of 3 x ¼ to 12 x 1½ inches.

The asphalt joint, type B, is adapted for paving and construction purposes where it is desired to keep the flow point in warm weather at a minimum and contains minute fibres and air cells evenly distributed throughout the entire mass so as to produce an elastic expansion cushion that does not liquefy or become brittle and has a strong tendency to retain its pre-moulded form.

Joint C for sidewalk work, inner curb work and other structures where the minimum is required for expansion and contraction is made in light and heavy styles, the former being from 1/32 to ⅛ inch in thickness and any width up to 12 inches. The heavy style is ⅛ inch thick and upwards and can be used in multiple strips, all of them furnished in 100-foot rolls.

MAXIMUM DEMAND WATER CONTROLLER

Some water supply systems are required to furnish an adequate minimum pressure for fire protection. If they also have one or more large consumers, whose demands are so great as to equal nearly the pipe line capacity, the pressure available for other purposes may be reduced seriously, although the pipe line can furnish the full amount needed by the large consumer without affecting the minimum pressures if the large quantity of water be delivered at a reasonable rate. For this purpose, a maximum demand or rate of flow controller, made by the Simplex Valve & Meter Company, has been developed that prevents the drop in pressure due to excessive peak demands on the water supply line.

The maximum demand controller remains open at the predetermined setting until the rate of flow reaches the prescribed maximum. From this point on, the opening of the controller is just sufficient to permit the specified rate of flow, and no more, to take place.

The maximum demand controller consists of a Venturi tube with a double-disk-type balanced valve. The valve stem is guided in the upper and lower covers, engages a diaphragm near the bottom of the valve body and at the top is attached through a flexible connection to the short arm of a lever or scale beam.

For any given rate of flow, there exists a certain difference between the water pressure in the valve body and that in the throat of the Venturi tube, due to the difference between velocities at these points. The downward pressure on top of the diaphragm is greater than the upward pressure below, and for this reason there is transmitted to the short arm of the scale beam a downward pull that is balanced by the counterweight on the longer arm of the scale beam. This balance of the counterweight and diaphragm loads limits the maximum rate of discharge through the controller.

Altering the position of the counterweight on the longer beam arm changes the maximum permissible rate of flow.

MORAND TRUCK WHEELS

Truck wheels made by the Morand Cushion Wheel Company have been adopted for all kinds of trucks by the owners of fleets of trucks and their methods and testimonials show that their use increases tire mileage and the life of the truck, and reduces maintenance charges. One owner states that on a Ford truck the cost of repairs for six months previous to application of the Morand wheels was $442.91. For six months after the application of the Morand wheels the corresponding maintenance cost was $143.98. The tire mileage was increased from 14,000 to 19,000 miles, the average load being 10,000 pounds.

SOLID TIRE CUSHIONED TRUCK WHEEL FOR ALL SERVICE

CONKEY CARS

Loose leaf circulars issued by E. E. Conkey & Company, illustrate design and specification of various types of small steel cars including scoop dump-cars for all standard purposes such as hauling sand, gravel, coal, concrete, with a turn-table body dumping on either side or end, and capacities of 12 to 27 cubic feet; platform cars up to 12 feet long and 6 feet wide with steel frames and steel or wooden floors that are suitable for all purposes and especially for transporting steel or wooden concrete batch boxes. The gable bottom cars dumping on either side are of 1, 1½ or 2-cubic yard capacity and are suitable for quarry and general contract work. Rocker dump cars are of 1 to 3-yard capacity, are suitable for hauling gravel, broken stone, concrete and other materials and can dump on both sides, discharging clear of the tracks. End dump cars are of 12 to 27 feet capacity and are especially adapted for use in tunnels where they require a minimum side clearance and ability to travel around sharp curves.

TRAILMOBILES AND SEMI-TRAILMOBILES

Trailmobiles are manufactured by the Trailmobile Co. in various styles and sizes adopted to hauling of all kinds of freight. The Model B, of 1,250 pounds capacity, has wooden wheels and is intended for general service behind a passenger car or light truck. Model C, of one ton capacity, is of similar design. Model K, of two tons capacity, is rubber tired and has a heavy chassis. Model L of 3½ tons capacity can be built with a box body, flat platform, rack, or with a dump body, desirable for general use.

MOTOR TRUCK BODIES

The catalog of the Auto-truck Steel Body Co. illustrates standard types and sizes of steel truck bodies and hoists and invites requests for the design and construction of any special bodies that may be required. It illustrates various types of standard steel bodies with round and square corners, with single and double tail gates, with doors and chutes, with asbestos lining for carrying hot asphalt. It lists various types of wooden box rack, stake, platform, and other types of bodies and shows the details of the Junkin horizontal hydraulic hoist, of a vertical hoist, and also of a hand hoist for dumping.

MECHANICAL SNOW LOADING

The Barber-Green loader was in continuous service in New York City for nearly a week last February in loading on trucks snow that had previously been piled in the street in long banks ready for removal. According to the records, it replaced ten men and saved the use of a third of the trucks otherwise required besides cutting down the loading time. In one hour it loaded 28 2-ton Mack trucks and on one occasion loaded a large truck in 58 seconds. In one day it cleared the snow from twenty blocks on Fifth avenue.